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XANTHOMATOSIS INVOLVING BONE (LIPOID HISTIOCYTOSIS)[1]

CASE REPORTS AND ROENTGEN FINDINGS

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THE concept of xanthomatosis includes a series of pathological conditions, in which lipoid substances are deposited in certain tissues of the body as a result of a disturbance of fat metabolism, which may be an essential primary process or one secondary to other constitutional disease, such as diabetes mellitus. These accumulations are found in various tissues, the composite picture differing greatly over a rather wide range of clinical cases, but in general considered by present-day investigators to represent a fundamentally similar pathologic process in all. It has also been variously termed "lipoid granulomatosis," "lipoid reticulo-endotheliosis," "lipoid gout," "lipoid histiocytosis," and "generalized xanthomatosis."

CASE REPORTS

Case 1. F. B., R-3680, a white boy aged three and one-half years, was admitted to the hospital July 29, 1927, with the complaint of multiple abscesses of the skull, exophthalmos of the right eye, ankylosis of the left shoulder, and pain in the region of the right hip. With him came a history of his having injured the shoulder in a fall in March, 1926. An abscess of the left tonsil had been opened in October, 1926, and one in the right temporal region arising without history of injury or other apparent cause in January, 1927. Other swellings had since appeared on the head, but had not been opened. The right knee pained occasionally. He had been delivered normally at full term and breast fed. Scarlet fever had occurred at nine months and severe mumps in March, 1927, each with good recovery. There was no history of other infections. His father, 26 years of age, his mother, 25 years of age, and his six sisters were all in good health.

Examination.—The right eye was displaced downward and outward, but was otherwise found normal upon examination by the division of ophthalmology. A soft, fluctuant, non-expansile mass about 5 × 6 cm. was present over the left parietal region, not inflamed. A soft mass 2.5 cm. in diameter underlay a sinus in the right temporal area which was discharging a serous fluid. The left shoulder was ankylosed in a position of adduction. The patient limped on the right leg, with pain in the right hip on motion. The physical findings were otherwise of no significance.

Laboratory study gave the following findings: Hemoglobin, 70 per cent; red blood cells, 3,700,000; white blood cells, 15,000 to 17,000 with polymorphonuclears (neutrophiles) 50 per cent, polymorphonuclears (eosinophils) 1 per cent, lymphocytes 41 per cent, large mononuclears and transitionals 8 per cent. Anisocytosis and poikilocytosis were present. The Wassermann (Kölmer technic) was negative on three ex-

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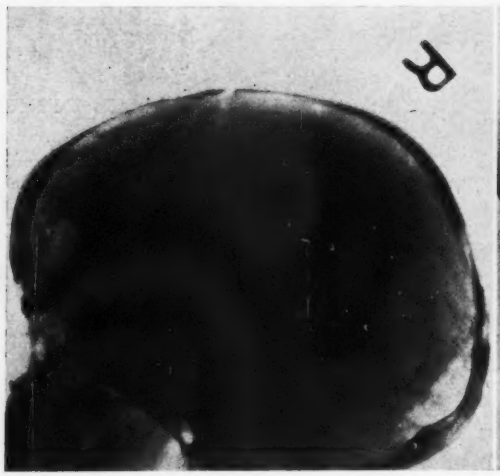

Fig. 1. Case 1. Multiple defects in cranial bones.

Fig. 2. Case 1. Extensive defects in right ilium with much reactive osteosclerosis.

aminations, the last two after provocative treatment. The von Pirquet skin test was negative.

Roentgen study (Aug. 3, 1927), gave evidence of multiple areas of bone destruction in the skull, left scapula, left acromion, and right ilium (Figs. 1 and 2). There was a "punched-out" appearance in the right fronto-parietal, left parietal, left parieto-occipital and lower occipital areas. A moderate amount of osteosclerosis surrounded the right fronto-parietal defect, and a considerable amount of osteosclerosis was present in the ilium. Irregular bone absorption occurred in the coracoid process, the neck of the scapula, and a portion adjacent to the articular surface. The bones about the right knee appeared negative. This was prior to Rowland's first communication discussing the xanthomatoses and the true condition was not recognized.

Between Aug. 30 and Nov. 14, 1927, areas in the left parietal, right and left temporal, left scapular and acromial, and the right iliac regions at the locations of palpable tumors and radiographically visualized bone defects were curetted, a hemorrhagic, yellowish, encephaloid mass being found at each. In the cranial operations this abnormal tissue was found lying between the periosteum and the dura. At the left parietal area two small lymph nodes external to the periosteum were removed which later gave histologic findings of interest. In the ilium a cyst-like cavity was found with a thin wall on the external aspect, the cavity filled with the tissue described plus about 20 c.c. of thin, straw-colored fluid. The outer wall here was easily crushed for approximate coaptation of walls.

A summary of the histologic findings follows (Figs. 3 and 4): "There is a peculiar granulation tissue rich in large mononuclear cells (histiocytes) resembling those of benign giant-cell tumor rather than those of tuberculosis. Large areas of hemorrhage and necrosis are present. In some areas polymorphonuclear infiltration is the predominating feature, a large number of the polymorphonuclears being eosinophils. Clusters of hemosiderin granules are numerous and some of the macrophages are loaded with blood pigment. Yellowish bodies with doubly contoured walls, about 50 micra in diameter, are found in small numbers. In the lymph nodes there are found hyperemia and edema with marked proliferation of endothelial cells, also macrophages with blood pigment and areas of histiocytes

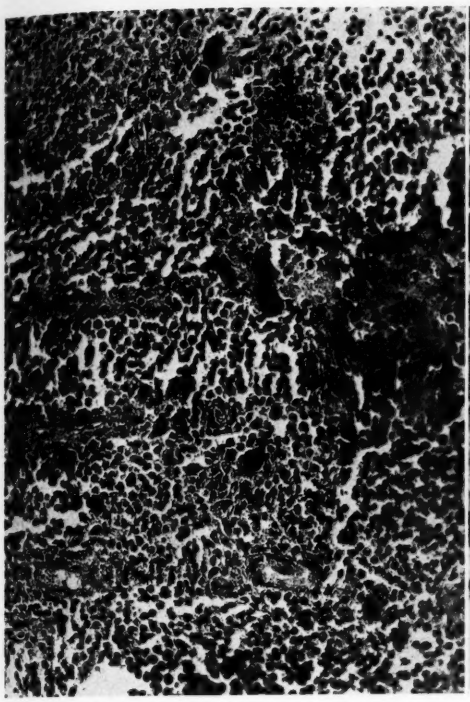

Fig. 3. Case 1. Photomicrograph, low magnification. Hematoxylin-eosin stain. Foam-cells not numerous, a frequent cause of error.

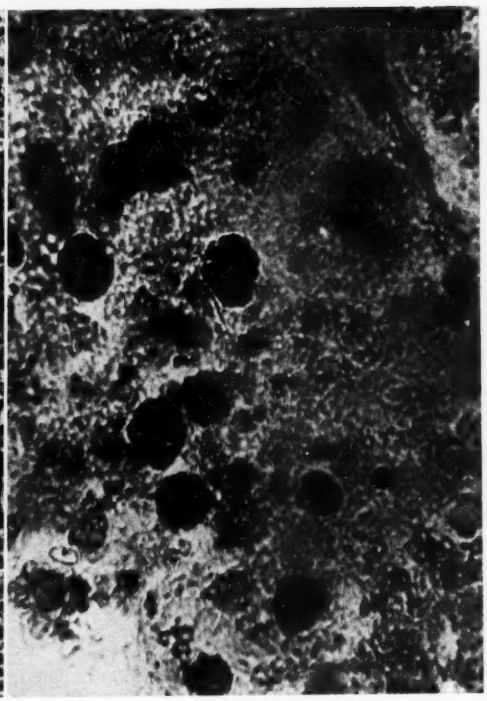

Fig. 4. Case 1. Photomicrograph, high magnification. Sudan III stain brings out intracellular lipoids. (This study was made subsequent to roentgen diagnosis.)

and giant cells similar to those previously described."

Laboratory study in February, 1928, showed blood calcium to be 9.3 to 10.7 mg. per 100 c.c. of blood serum (method of Clark and Collip). The red blood cells numbered 5,100,000 per c.mm., white blood cells 12,860, with a differential count approximately as before.

On May 14, 1928, radiographically there was found healing in the bone defects of the skull, with development of many new defects.

The patient did not return for further study until August, 1934, when roentgen study of the various areas of involvement indicated that there was practically normal bone structure (Figs. 5 and 6). It was now recognized (L. A. S.) that the condition was Schüller-Christian's disease. The ophthalmologic examination showed vision to be O. D., 10/200, O. S., $20/20^{-2}$. The eye-grounds appeared normal. There was a crossed diplopia upward and to the right and a homonymous diplopia on the left with the left image higher in left oblique positions.

The patient returned Nov. 16, 1934, upon request. There was nothing new elicited in the history or physical examination at this time. There had been no polyuria at any time. The eye-grounds were studied again in view of the late findings in Schüller's first case, with normal findings. The blood-count was essentially normal except for a slight anemia (12.5 g. hemoglobin). Blood cholesterol was 173 mg. per 100 c.c. of serum (method of Meyers and Wardell).

Comment.—This patient's examinations and operations occurred before Rowland clarified the subject of xanthomatosis.

Fig. 5. Case 1.

Fig. 6. Case 1. Complete absence of osteosclerosis seen in Figure 2.

There was no familial history. An injury preceded the localization in the shoulder, but no element of trauma or infection could be elicited in connection with localization of changes in the other areas. The bone lesions did not resemble radiographically in their entirety those described in other cases, in that there was evident reactive osteosclerosis in places and some osteoporosis about one area in the skull. This osteosclerosis has now disappeared. Bone healing, while ultimately quite good, did not follow immediately after the surgical attacks. While the histological findings are rather characteristic of Schüller-Christian's disease, the diagnosis, although late, was ultimately made from the characteristic roentgen findings. The eye abnormalities have not improved in spite of the operative work and general improvement. The future course will be followed.

Case 2. The history of this case up to Oct. 5, 1930, was reported by Mettel (38), therefore only the essential details will be presented here.

History.—W. P., R-950, aged 2 years 8 months, was first seen Nov. 25, 1928, with the complaint of a swelling on the right side of the forehead.[2] This swelling appeared in July, 1928, immediately after the head had been accidentally struck, and had continued during the intervening time. It was of rather soft consistency. The family history was irrelevant.

Examination.—The child was well nourished and moderately well developed. General examination gave normal findings except for the cranial tumor. Over the right frontal bone there was an apparent defect 4 cm. in diameter in the skull, with a bruit audible over it. Radiographs of the skull (Fig. 7) gave evidence of a bone defect in the right frontal area, with some evidence of bone regeneration about the margins. No history had been sent with the requisition for examination. Study of the long bones and pelvis gave no evidence of any osseous lesion here and temporarily the diagnosis was left undetermined from the x-ray standpoint, but malignancy was suggested, or possibly syphilis.

Course.—Anti-syphilitic treatment was of no benefit. On the diagnosis of probable hemangioma, radium was applied by Dr. W. H. Kennedy between December, 1928, and December, 1929. Unfortunately, full details of radium dosage are not available. When seen on April 1, 1930, the lesion of the frontal bone had almost cleared clinically, but during the previous two months there

[2] Through a typographical error, the age was given in the original report as 5 years.

Fig. 7. Case 2.

Fig. 8. Case 2.

had developed at the junction of the left parietal and occipital bones a new area similar to the first, somewhat tender, about 3 cm. in diameter. Radiographic study gave evidence that the original bone lesion was materially smaller, but some nine or ten new defects had appeared in various parts of the cranial walls, varying in size from about 1 to 10 cm. in diameter, with lack of bone detail in the superior portion of the greater wing of right sphenoid and about the superior orbital fissure. The largest defect was in the left posterior parietal region just above the occipital bone. While the edges of the bony defects were for the most part sharply demarcated, there was a frayed appearance in some areas. On the basis of these radiographic findings we made in the roentgen department (L. A. S.) a diagnosis of Schüller-Christian's disease and obtained further roentgen study April 29, 1930, finding no bone changes in the long bones, feet, ankles, or hands. The spine was not examined. There was pulmonary fibrosis of the type which had been previously described in Schüller-Christian's disease.

Except for word to Dr. Mettel, Oct. 5, 1930, that no new lesions had appeared and that the old occipito-parietal lesion was gradually disappearing, no further information regarding the patient was obtainable until August, 1934, on account of his having moved to another State.

When seen again for roentgen study on Aug. 10, 1934, at the special request of Dr. Mettel, there was almost complete bony healing in the areas previously involved (Fig. 8). In the posterior portion of each parietal bone there was slightly less density than normal and a slight cranial deformity remained. The clinical condition was good, with no evidence of either old or new xanthomatous lesions. No further medical treatment had been followed.

Comment.—The diagnosis was made here upon the roentgen findings, in spite of the normal blood cholesterol and absence of any of the symptoms of "Christian's triad," after the development of multiple bone lesions, Rowland's contribution having recently appeared. At that time less than twenty case reports could be found in the literature. There is nothing character-

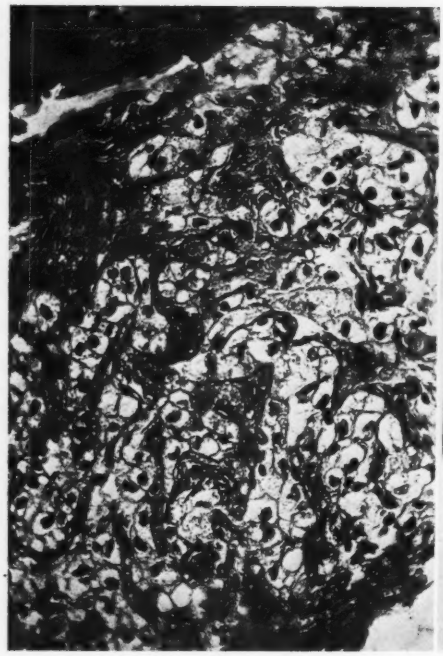

Fig. 9. Case 3. Photomicrograph, high magnification. Hematoxylin-eosin stain. Many large, clear foam cells.

Fig. 10. Case 3.

istic of xanthomatosis about the first bone defect shown, and no instance of radiographic recognition of such a single lesion has come to our attention. The reactive osteosclerosis here, as in Case 1, is atypical. The continued down-grade course after radiation therapy, with subsequent improvement, has been noted in other cases (23, 52). Presumably this patient has benefited greatly by reason of his radiation treatment, as have others with this condition. As in Case 1, the subsequent course cannot be foretold in view of other reported cases, but it would seem that the outlook is good.

Case 3. Mr. K., a white male, aged 69 years, consulted us March 13, 1934, because of a soft, moderately painful tumor over the lower part of the left scapula which had first appeared the previous August and which had been growing more rapidly in recent weeks. The opinion expressed by two competent pathologists after histologic study of a biopsy specimen was that the condition was a primary xanthoma. Roentgen study gave evidence of an area of bone destruction in the wing of the scapula, 2.5 by 5.5 cm. in diameter (Fig. 10), with faint bony trabeculations extending outward from the plane of the wing of the scapula. The margins of the bony defect were rather sharply defined, with little or no evidence of any reactive process. No similar or other pertinent findings were obtained in other parts of the body, radiographically or clinically. The blood cholesterol was 172 mg. per 100 c.c., within the range of normal.

The lesion has proved radioresistant. While slow response to irradiation has been reported elsewhere in xanthomatous tumors (52), as in Schüller-Christian's disease, it seemed wise to submit the case to the Registry of Bone Sarcoma, a report

from which has classified it as a metastatic hypernephroma with xanthomatous changes (Bone Sarcoma Registry No. 1832).

Comment.—The occurrence of secondary xanthomatous changes in various bone tumors has been found in various conditions (2, 28, 30, 45, 48, 60). A single, primarily xanthomatous tumor such as this would be quite unusual, and the later histories of cases that have been reported as such should be carefully followed.

Present Classification of Xanthomatosis.—Rowland, Pick and others (19, 42, 52, 58) have discussed the historical background of these conditions and it will not be repeated here. Since Rowland's important communications which have formed the basis for the present concept of lipoid metabolic disturbances, extensive additions have been made to our knowledge of the general condition. Rowland and many others have held that the essential process occurring in the primary xanthomatoses is a reticulo-endothelial storage in the sense of a phagocytic accumulation of substances occurring in unphysiologic concentration in the blood stream, these substances being cholesterol and its esters. Pick disagrees with Rowland as to the reticulo-endothelial origin of the phagocytic cells concerned, contending that in Christian's disease, as in Niemann-Pick's, only the origin from reticulum cells and histiocytes of adventitia and perivascular connective tissues has been demonstrated. While agreeing with the concept of a disturbance in lipoid metabolism, subsequent investigators (16) have found that: (1) Unphysiologic concentrations of cholesterol or cholesterol esters in the blood are sometimes, but not necessarily, associated with xanthomatous cell tumors or granulomas; (2) xanthomatous tissue changes may occur without increase of cholesterol in the blood; (3) while an accompanying hypercholesteremia may sometimes be favorably influenced by a prolonged dietary regimen, improvement of the pathologic tissue changes may not necessarily follow, and (4) the etiology of various forms or types of xanthomatosis is still to be determined. The lipoid occurring in Gaucher's cells is kerasin, in Schüller-Christian's disease chiefly cholesterol and its esters, and in Niemann-Pick's disease phosphatid lipoids or lecithin (16, 41). In Gaucher's disease no known changes occur in the chemistry of the blood. In Schüller-Christian's and Niemann-Pick's diseases the blood cholesterol is often increased (16, 19). Michael and Nicholas (39) have given an extensive review of the blood chemistry in xanthomatosis.

In connection with the third case discussed here we may note that in the localized xanthomas we may have (16, 41): (1) the non-neoplastic type as exemplified in the skin of the eyelids or about inflammatory conditions; (2) true neoplasms as represented by xanthomatous blastomas, sarcomas, or carcinomas. We are told (16) that as a rule xanthomatous features are found only in these tumors which are located at the tendons or in the skin, but radiosensitive xanthomatous tumors have been found in the breast (17) and the characteristic foam cells of xanthoma have been found in tumors of the bone marrow apparently related to the so-called osteitis fibrosa cystica of von Recklinghausen (2, 26, 30, 45, 48, 60). Schroeder reports one case and discusses three others from the literature in which a xanthomatous giant-cell tumor involved a single bone. Schrank and König have each found isolated xanthomatous bone tumors. Knapp has reported two instances in each of which a xanthomatous tumor has involved only that portion of the frontal bone forming the roof of the orbit, each apparently cured by surgical excision. In view of the occurrence in a case of Sosman's of an iliac lesion, very probably of a xanthomatous character, 5 years and 9 months after the first discovery of a cranial bony defect and 17 years after the development of diabetes insipidus, it remains a matter of conjecture whether such apparently localized bone defects as those mentioned above may not ultimately be followed by other bony lesions of like nature. It is recognized that various types of tumors may undergo xanthomatous changes (Pick and others), but the investigators re-

porting the above-mentioned cases have considered that they were dealing with bone lesions primarily xanthomatous.

Pick discusses an as yet unnamed subgroup among the class of essential non-symptomatic xanthomatoses which also represents a disease of the bones and which he considers may present a characteristic roentgen appearance. Only a few cases have been observed. The condition may occur in any age period or in either sex. As in Schüller-Christian's disease, a lipoid granulomatosis occurs in lipoid-containing cells which are widely distributed in the bone marrow all over the skeletal system. However, as contrasted with Schüller-Christian's disease, it is more evident in the diaphyses of the long bones than in the skull, the healing foci are delimited by bony trabeculæ, and they are associated with an extensive osteosclerosis. Xanthomatosis of the skin or internal organs may be present or absent. The character of the deposited lipoids is not as yet fully known.

The foregoing applies to *lipoid* histiocytosis. In comparatively recent literature a condition of *non-lipoid* histiocytosis (9) has been delimited.

The following outline of the histiocytoses may then be formulated:

Lipoid histiocytosis

(*A*) Primary or essential forms, constituting disease entities in themselves and based upon a constitutional anomaly of lipoid metabolism:
1. Gaucher's disease.
2. Niemann-Pick's disease.
3. Hand-Schüller-Christian's disease.
4. Various non-symptomatic external and internal xanthomatoses, including an unnamed group with characteristic bone changes, chiefly in the long bones.
5. Exogenous, experimental cholesterosis (41).

(*B*) Secondary or symptomatic forms:
1. Those occurring in disturbances of lipoid metabolism, especially in hepatic and diabetic conditions.
2. Forms found in various granulomatous, sarcomatous, or carcinomatous tumors.

Non-lipoid histiocytosis (also termed "reticulo-endotheliosis," "aleukemic reticulosis").

It is very doubtful whether the osseous forms can be considered as special nosological entities but from the roentgenologist's standpoint it is important to consider this group, since in many instances the xanthomatous cell proliferation is restricted to the organs of the hematopoietic system. The bony changes often are pathognomonic and the increasing number of reported cases of this type indicate a greater incidence than has hitherto been recognized, although these are not of frequent occurrence. They may well be considered among the bone diseases of childhood, since most of the radiographically demonstrated osseous lesions have been found in this age, chiefly in that condition known as the Hand-Schüller-Christian's disease, to which attention will be principally directed in this communication.

In the general non-symptomatic xanthomatoses, destructive or cystic bone changes may rarely be found (44).

Niemann-Pick's disease is associated with macroscopically visible bone alterations in only the very exceptional case. These consist of osteoporosis or a bone atrophy of quality (44).

The solitary xanthomatous tumor, with or without underlying or associated neoplastic changes of other nature, seems to have no characteristic roentgen appearance, except that it may present the same clear-cut bone defects which characterize the changes in Schüller-Christian's disease. It may have a cystic appearance (29, 47) and there may be a laminated periosteal reaction (29). There seems to be no constant syndrome of symptoms and the diagnosis rests ultimately upon the histologic findings. In such cases it is evident that errors will often occur by reason of the xanthomatous changes overshadowing the essential characteristics of the underlying tumor.

Gaucher's Disease.—This has been classed

with the splenic anemias. It is on the average a more chronic type of disturbance of lipoid metabolism and may occur at any age, although it usually begins in infancy. It is infrequent in occurrence, only 117 cases having been reported up to 1931 (42), and is associated with spleno-hepatomegaly, hemachromatosis, a hemorrhagic tendency, bone changes of unusual type, anemia, and frequently thrombocytopenia. It may run a very acute course or may last for many years with comparatively slight symptoms. The most important histologic feature is the Gaucher cell, which is diagnostic. Skeletal changes have in some instances become a prominent feature after splenectomy.

Histologic evidence of extensive skeletal involvement is frequent but radiologically demonstrable lesions seem to occur in only some 22 per cent of cases (42), as far as can be determined by the very incomplete data upon this point, although in one series of eleven, bone changes were found in six (58). No instances of Gaucher's disease with osseous lesions have come under our personal observation.

The skull is not often involved. Pick and others have reported the changes found. The femur may be the only bone with demonstrable changes in the early stage (42), in which case there is the frequent finding of areas of rarefaction of various sizes, in some instances with intervening sclerosis, giving a "worm-eaten" appearance. A club-shaped expansion of the lower third is so constant that it is considered by some (58) to be a diagnostic early roentgenologic sign and, in most instances recorded, the femoral neck and head have been the site of osteoporosis and irregular rarefaction and condensation which have permitted development of marked deformities. The other long bones have been the seat of similar changes. Histologically, the lesions have been found in practically every bone in the body. Involvement of epiphyseal areas have caused growth disturbances.

There has been at times a condensation and expansion of the bone. Thinning of the cortex is common, due to exertion of mechanical pressure by reason of growth of the Gaucher cells. Pathologic fractures occur. Involvement of the vertebræ may be extensive, with resulting collapse of one or several bodies and consequent gibbus formation. The intervertebral discs are ordinarily intact. The literature upon these aspects has been reviewed by various writers (26, 42, and 58).

The differential diagnosis from the roentgen findings is simple if the characteristic changes are present in the lower femur. The true condition may well be suspected if the spine is the first part examined, but similar changes have been found in Schüller-Christian's disease. No other disease presents the same composite skeletal appearance, but in a case of non-lipoid histiocytosis (reticulo-endotheliosis) we have found a quite similar set of bone changes, there being cystic-appearing areas in one vertebral body and partial collapse of several bodies, with general rarefication in the lower femora and upper tibiae. In this instance diagnosis was made from an excised lymph node. Tuberculosis of the spine differs in its characteristic destruction of the intervertebral disc and in the presence of an abscess; furthermore, there is very little hyperplastic bone repair in Gaucher's disease. Hodgkin's disease of bone may present a very similar roentgen appearance. Osteitis fibrosa cystica, Cooley's anemia, other lipoidoses, syphilis, tuberculous disease of the hip, the various deforming conditions of the hip and the anemia associated with osteopetrosis are readily differentiated if Gaucher's disease with its clinical symptoms is kept in mind. Histologic demonstration of the Gaucher cell is the final proof of the correct diagnosis.

Schüller - Christian's Disease.—Schüller-Christian's disease has been variously termed "Christian's syndrome," "Hand-Schüller-Christian's disease," "generalized xanthomatosis," "lipoid granulomatosis," or "Hand's disease."

Symptoms of xanthomatosis of the Schüller-Christian type begin most frequently in the first decade of life, the age

limits of 1–7 years including a very considerable number of the cases summarized by Henschen and Vlavianos, as well as those reported since that time. A few older patients have been reported by Alberti (21 years); Kienböck and Selka (23 years); Chiari (26 years); Vlavianos (27 years); Seeliger (32 years); Hochstetter, Lyon, Gaál (38 years); Gaines (47 years), Gaucher's disease (?), and Sosman (55 years). The adult form of the Schüller-Christian-Rowland type, as distinguished from the Gaucher and strictly localized types, is thus seen to be rather rare.

The male sex is the more frequently affected in Schüller-Christian disease. In contrast to xanthomatosis in general (19, 57), there is no familial or racial predisposition indicated by recorded histories of patients with this type of lipoid disturbance, although Pick contradicts both of these views. He indicates that the Jewish race is more often affected than others.

The onset of symptoms in this type is often insidious, these often consisting at first of a tumefaction of rather soft consistency, which may or may not be tender on pressure. In this disease the lesions are found in the bones much more than in any other parts. The cranial bones have been involved in practically all of the cases, but the bony pelvis, femurs, maxilla, mandible, ribs, vertebræ, humerus, and scapula in descending order of frequency, have been reported as harboring the lesions. Clinical symptoms depend almost exclusively upon the anatomical parts affected and the consequent disturbances of physiology. Thus, two symptoms which led to its recognition as an entity in "Christian's triad" of defects in membranous bones, exophthalmos and diabetes insipidus, are recognized as depending upon involvement of the orbits and the hypophysis. The autopsy reports in various cases indicates that actual xanthomatous infiltration of the hypophysis is of great importance in relation to diabetes insipidus (6, 21, 31, 44, and 55), and it may be assumed that this is also the case in those patients showing retardation of growth or dystrophia adiposo-genitalis (41), although there seems to have been no instances where a complete autopsy study of the endocrine glands has been made in this condition (19). Loss of teeth, deafness, discharging ears, pains in head, back and extremities, alterations of gait, optic neuritis, backward mental development and anemia are all thus similarly explained. Vlavianos' patient showed symptoms indicating the probability of cerebellar xanthomatous deposits. Special mention should be made of the strong tendency to fibrosis in the lungs, where this process of reaction and repair is more readily studied roentgenologically than in other vital organs. The lesions here have in a number of cases been the direct cause of death. Generally speaking, the subjective symptoms are strikingly slight considering the anatomic changes existing and the general condition may long remain quite good or may improve as a result of retrogression of these anatomic changes.

The onset of symptoms has been varied, acute in some, as in the first case reported (18) who suddenly developed diabetes insipidus; or insidiously with retardation of physical or mental development and occurrence of external cranial tumors, dental symptoms or pains in one or more parts of the body. The onset of the disease has in many instances followed an acute infection, general or local, and local trauma has appeared to be a factor in determining the location of many of the osseous lesions. The clinical course is likewise varied, in which respect it occupies an intermediate position between the related conditions of Niemann-Pick's disease, which always occurs in infancy and runs a very rapid course, and Gaucher's disease which may occur in infancy or, more frequently, in later childhood and which tends to run a chronic course over decades. The patient may die within the first year after onset of symptoms (18, 19, and 50). Others have been followed for periods of five years (15), six years (10, 14, and 22), and seventeen years (36 and 49), one of the last-named references reporting the first case observed by Schüller, the patient longest under ob-

servation. This patient at last observation was physically active, normally developed, and almost symptom-free. In a few patients other than Schüller's the bone defects have undergone spontaneous retrogression (3, 13, 22, and 44). Between these limits there have been various gradations of severity of symptoms and length of course.

The bone changes are usually those of absorption only, this being striking in degree and in numbers of areas involved. Periosteal thickening is unusual but may occur (44).

Lazarewa tabulated the areas of bone involvement in 27 reported cases as follows:

Skull	27 cases	100%
Sella turcica	5 cases	19
Maxilla	7 cases	26
Mandible	6 cases	22
Bones of pelvis (usually ilium)	14 cases	52
Vertebral column	3 cases	11
Ribs	4 cases	15
Scapula	1 case	4
Femur	7 cases	26
Humerus	3 cases	11

However, in many instances the skull has been the only part radiographed and, therefore, such statistics are of only relative accuracy.

The most definite and characteristic bony changes occur usually in the skull, these having been found with great constancy in the reported cases. Defects are found, involving both inner and outer plates usually, which may be only from 2 to 3 cm. in diameter but which are often much more extensive than the palpable swellings and may affect the whole base of the skull. They are multiple in the typical case or soon become so, giving rise to the now classical terms of "geographic skull" applied by Schüller and the "moth-eaten" appearance noted by Christian. The margins are rather regular, sharply demarcated and with strikingly little reaction evident in the immediately adjacent bone, although there has been found a rarefication zone close by (52). Some (5, 22, and 46) have reported marble-like osteosclerosis between the defects. The bones of the anterior cranial fossa, the orbits, maxilla, and mandible are also often affected. New defects may appear while the old are healing, as occurred in one of Sosman's patients and in Case 2 of those presented here. The petrous pyramid has in some instances been extensively absorbed.

Next in frequency of involvement as compared with the skull are the pelvic bones, defects here varying from a scarcely discernible change up to marked deformities.

Of the long bones, the femur is the most frequently affected. There is a simple loss of substance with usually no evidence of osteosclerotic reparative reaction adjacent in those radiographs reproduced in case reports, except in quite isolated instances (5 and 57). In this connection the osteosclerosis present in the ilium of Case 1 of this communication is of interest and its replacement by normal bony structure later is most unusual. The bones of the leg have been infrequently affected (1, 5, and 50), and those of the forearm even less often (50). Only one instance of tarsal disease seems to have been found (calcaneus). Otherwise the bones of the ankles, feet, wrists, and hands have apparently not shared in the gross absorption.

Lesions of the vertebræ have been relatively less frequent and less extensive than in Gaucher's disease. The body of a single vertebra has been found flattened (3, 46, and 55), and in one instance (46) rounded areas of destruction were found in the body of a cervical vertebra. The latter has been found in non-lipoid histiocytosis by various observers including ourselves. The intervertebral discs are ordinarily intact although Schotte found decrease in three spaces in the same patient.

Pathologic fractures have occurred (3, 7, 19, 25, and 50). Bone healing of the usual defects may in time occur spontaneously or it may follow roentgen (7 and 52) or radium treatment (23), as in one of those herewith presented. The lungs should always be studied radiographically, since healing of the xanthomatous deposits here tends strongly toward production of fibrosis, patchy or generalized.

Differential diagnosis from the roentgen aspect in Schüller-Christian's disease is

very greatly simplified in the well-marked case by the characteristic findings. Multiple myeloma, osteogenic sarcoma, metastases from the various malignancies, cystic bone disease, hemangioma, giant-cell tumor (especially in a vertebra), deforming osteochondritis of the spine, tuberculosis of the bone, non-lipoid histiocytosis, congenital syphilis or the early stages of osteitis deformans (osteoporosis circumscripta cranii of Schüller) may conceivably enter into the differential diagnosis in the individual case. In Schüller-Christian's disease there is typically an absence of reaction in bone adjacent to the lesions. The distribution of bone lesions, presence of other evidences of disturbed lipoid metabolism (possibly with high blood cholesterol), demonstration of one or more of Christian's triad of symptoms when present, or of other symptoms as noted will usually point to the diagnosis. Where possible, demonstration of the typical foam-cells in the histological specimen clinches the diagnosis in many instances, but histological study frequently fails to reveal the true condition (44).

Treatment of essential xanthomatosis in all its forms except the localized variety has accomplished only palliative results. Aside from symptomatic treatment, surgical excision of localized lesions, irradiation of local or general areas of involvement and restriction of fat intake, there is no therapy which seems directly helpful. Spontaneous retrogression often occurs. Previous reports upon radiation therapy have already been mentioned. Our first patient, however, improved after surgery without radiation treatment and is at present in good condition clinically. The discouraging preliminary response of Case 2 was followed by healing and lack of development of new defects, with a good general and skeletal condition persisting up to the present. The xanthomatous tumor in the elderly patient is improving slowly in that the size is reducing, new bone is appearing in the tumor substance and the movements of the part are less restricted. The slow local response here is no doubt due to the radioresistance of the underlying tumor, the lipoid characteristics being merely an associated feature which has confused the picture, as has no doubt been the case with some of the apparently primary single bone tumors which have been reported in the literature as being essentially xanthomatous.

SUMMARY

1. The case histories and roentgen findings of two patients with Schüller-Christian's disease and one with a metastatic hypernephroma associated with xanthomatous changes are presented with their roentgen findings. The latter exemplifies a condition not unusual but readily confused with bone tumors of simple xanthomatous nature, much more benign and of much rarer occurrence.

2. One of the Schüller-Christian cases presented a marked but temporary osteosclerosis surrounding one bone lesion, the entire area being later filled with normal bone. This is quite unusual in xanthomatosis.

3. Both cases of Schüller-Christian's disease now appear clinically well, one spontaneously after extensive operative treatment and the other after radium therapy.

4. The classification, roentgen findings, differential diagnosis and radiation therapy of the various xanthomatous lesions affecting bone are discussed and the literature reviewed.

5. The roentgen findings are often of greater importance in diagnosis than the histological, particularly in Schüller-Christian's disease after the earlier stages.

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THE TREATMENT OF HYPERTHYROIDISM BY ROENTGEN IRRADIATION OF THE PITUITARY GLAND

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I.—HISTORICAL DEVELOPMENT OF THE PROCEDURE

RADIOTHERAPY of the pituitary gland was introduced about twenty-five years ago for pituitary tumors (Gramegna, Béclère, 1909). Since an improvement in gynecologic symptoms was frequently noted as a result of this form of treatment the trial was made of radiation of the pituitary gland in a whole series of gynecologic disorders (Hofbauer, 1922, Werner and Sahler, 1923). I myself reported in 1924 some observations which I made leading to the supposition that perhaps radiotherapy of the pituitary gland not only might favorably influence ovarian disorders but also might have a favorable effect on the symptoms due to hyperthyroidism. In 1924 I observed a patient who had an oligosymptomatic thyrosis and who was referred for radiation of the pituitary gland for amenorrhea. Four weeks after completion of treatment not only had the subjective symptoms all disappeared but the basal metabolic rate, which had been +35 per cent, had returned to normal. Even more interesting was a patient I observed with my colleague Kriser, who was treated by hypophyseal irradiation for a myoma. There was no effect on the myomatous bleeding, but many of the hyperthyrotic symptoms from which the patient suffered were improved very definitely, and also the patient's goiter decreased in size. I reported this last observation in a paper in 1925 on the interrelationship of the glands of internal secretion. In that same paper I mentioned a case of acromegaly that had a basal metabolic rate of +36 per cent before treatment, which decreased to normal by the end of treatment and which subsequently showed no increase above normal.

Observations of this sort were very puzzling with our knowledge of the endocrine glands of that time, because in the texts on the endocrine glands the relationship of the thyroid and the pituitary glands was regarded as an antagonistic one and, according to this idea, there seemed to be no valid reason for suspecting that hyperthyrotic symptoms could be favorably influenced by radiation of the pituitary. For example, Biedl summed up the opinion of sixteen authors as follows: "The removal of the thyroid gland or the pathologic destruction of this gland in man is constantly followed by an increase in the size of the pituitary gland. The tissue changes are partly in the anterior lobe in which there is a hypertrophy of the chief cells and also a definite increase in the eosinophilic cells." Biedl also states, on the other hand, "Occasionally an acute hypertrophy of the thyroid gland occurs as a result of partial hypophysectomy." Similar observations were made in man. Hochenegg (1908) described a case in which, six months after extirpation of a pituitary adenoma, the thyroid of the patient, a woman 34 years old, with acromegaly, definitely enlarged. Exner also noted similar changes in a 34-year-old acromegalic patient. On the other hand, Kraus found in Basedow's disease that the hypophysis is small and of subnormal weight, the basophilic cells increased, and the eosinophilic cells decreased. These findings in experimental animals were confirmed by some effects of therapy in man. Teleky, Kümel and others state that they obtained improvement in some cases of acromegaly by the administration of thyroid tablets. Moreover, Pal

and Goldschneider state that they have produced improvement in cases of Basedow's disease by administration of pituitary extracts. In regard to radiation of the pituitary for symptoms associated with the climacteric, as carried out by workers both in this country [Austria] and abroad, I have made the observation that in those cases in which radiation of the pituitary produced no result oftentimes irradiation of the thyroid gland produced a favorable response. This observation also seemed to confirm the opinion that there is an antagonism between these two organs, so that an ovarian upset might influence one or the other of these organs to a more pronounced extent than the other.

On account of this wealth of observation and assertion in favor of an antagonism between the pituitary and thyroid glands, any synergistic relationship between them seemed hardly to be worth taking into consideration.

I myself would never have dared to draw any practical conclusions from all this evidence if the late Dozent H. Pollitzer, at that time assistant in Ortner's clinic, had not given his paper at the Wiener Gesellschaft für innere Medizin, in June, 1925, on "Exchange Reactions and Their Importance in the Pathology and the Indications for Treatment of Basedow's Disease." In this paper Pollitzer developed the conception that Basedow's disease is not an individual disease, but a syndrome, much as fever is, a complex of disturbances of various nerve centers, for example, the center for gas exchange, for cardiac stimulation and depression. These centers may be involved by disorders of the thyroid and of other organs. Since there is probably a psychogenic or genital Basedow's disease, Pollitzer says there is probably also a hypophyseal. The pituitary gland may secrete, as the thyroid does, an iodine-containing colloid which produces pathologic changes in the nerve centers just as does the secretion from the thyroid. The main characteristic of hypophyseal Basedow's disease is that thyroid changes are lacking, a high grade tremor that may even produce ataxia, a definite gas exchange index found by multiplying the basal metabolic rate by the percentage specific-dynamic protein effect, and, finally, a lack of effect from iodine.

I took it as somewhat of a paradox that Pollitzer in these cases advised irradiation of the thyroid and not of the pituitary, as the latter procedure seemed to be the more plausible one theoretically. However, it was interesting that, according to the views of this celebrated internist, irradiation of the pituitary was logical in certain cases of hyperthyroidism. What seems more important though is that Pollitzer gave in this presentation some of the indications by which cases suitable for this treatment might be selected. Even though we were somewhat confused by the fact that radiation in two cases which Pollitzer regarded as hypophyseal did not produce a favorable result, still the idea of a hypophyseal Basedow's disease has persisted in the Holzknecht Institute, and has worked out practically, so that, in cases of hyperthyroidism in which irradiation of the thyroid has not produced the expected result, treatment of the pituitary is tried. And Holzknecht himself, as well as all of us, had a definite impression that hypophyseal irradiation really did produce a result in some cases in which irradiation of the thyroid previously had been without effect.

We most likely would have stayed in this period of uncertainty an even longer time if some publications about the subject had not given us definite reasons for changing our technical and practical concepts of the condition.

The first important disclosure was made in a paper of Juggenberg, from the State Roentgen Institute, in Leningrad, which appeared in 1930, and which was entitled "Unsere Methode der Röntgenbehandlung der Basedowkranken bei alten Frauen" (Our Methods of Treating Basedow's Disease in Old Women). The author had the impression that x-ray treatment of the thyroid in aged women with Basedow's disease gave poorer results than in younger women. She proposed the method of treating disorders of the climacteric by irradia-

tion of the pituitary or thyroid gland. As has been mentioned, I had found that, in cases in which irradiation of the pituitary had produced no benefit, treatment of the thyroid had often produced a favorable result. Juggenberg, therefore, carried out an analogous experiment on hyperthyroidism by an opposite procedure. She had tried hypophyseal irradiation in cases in which irradiation of the thyroid had produced no result. She reported the detailed histories of seven women in whom typical symptoms of Basedow's disease had come on, after the climacteric, treated in vain with medical means and by irradiation of the thyroid, who were markedly benefited by irradiation of the pituitary. In two cases Juggenberg substantiates the therapeutic result by photographs of the patients, in the others by the basal metabolic rates and the other clinical findings. These results might be surprising for one who had heard of them for the first time, but they were very convincing to others, such as myself, who had had an opportunity to make similar observations. At a meeting of the International Congress of Physical Therapy, in Lüttich, in September, 1930, at which the roentgen therapy of hyperthyroidism was discussed, I stated that my observations were in perfect accord with those of Juggenberg, with the reservation that I differed from her in the indications for the selection of cases. I reported at that time on ten cases that had been treated by irradiation of the pituitary in the interval of the five years between 1925 and 1929. Of these ten cases, four had been markedly benefited over a period of years, while in the other six cases there was no definite change for the better.

These practically unsatisfactory and theoretically obscure results took on a different aspect when I compared them with those reported by Juggenberg. It appeared that in the case of the four women who were benefited by treatment, we were dealing with women in whom hyperthyrotic symptoms first came on during the climacteric, while the six unbenefited cases were all younger women. The benefit from irradiation in women with hyperthyroidism at the age of the climacteric and the failure in younger women was in part a confirmation and in part a supplement of the work of Juggenberg.

This purely empirical stage in which the results were obtained accidentally was soon followed by one in which the indications for the selection of cases began to crystallize. The third period began in the year 1932, when the therapeutic effects which, up to then had completely lacked any experimental explanation, were established on an experimental basis, and thereby were more readily understandable. This explanation is due to a whole series of reports on animal experiments which have been great contributions to our knowledge of endocrinology and of biology.

II.—BIOLOGIC FOUNDATION OF THE PROCEDURE

In the year 1929, Loeb, an American, and Aron, in France, independent of each other, reported that a short time after the injection of extracts of the anterior lobe of the pituitary into guinea pigs there occurred a marked hypertrophy and hyperplasia of the thyroid gland to the extent that it could be seen even grossly. If the intraperitoneal injections were made on five consecutive days, the weight of the thyroid gland doubled. The first histologic changes could be appreciated about two hours after injection, and these started in the center and progressed toward the periphery. The low cubical epithelium was replaced by a high cylindrical one. The cells showed a great increase in mitotic figures, from about 100 to 40,000. They proliferated in the form of buds into the lumen of the acini. The colloid lost its staining properties, and finally disappeared completely. The thyroids of the animals which had received the injections of hypophyseal extracts underwent all the changes of an increasing proliferation, associated with a typical Basedow's disease of the thyroid in man. Changes similar to those observed in guinea pigs were observed also in rats, mice, rabbits, cats, dogs, chickens, and ducks. In all these animals the intensity was depend-

ent on the intensity of the stimulus, that is, on the number of the injections. The changes were reversible, in that they returned toward normal if the injections were stopped.

Janssen and Loeser showed that this was not a specific protein effect, because the thyroid did not undergo similar changes after the injection of milk or of tissue extracts.

By this work the existence of a real thyreotropic hormone in the anterior lobe of the pituitary gland was demonstrated with the same certainty with which a gonadotropic pituitary hormone had been demonstrated a short time before by other workers. It could be shown that the thyreotropic hormone is effective only when injected or implanted, not when it is given by mouth.

The changes in the thyroid occur after the extirpation of the cervical sympathetic, which shows that they are not produced by the agency of the nervous system. They may also even be demonstrated if the thyroid is severed from all its usual connections, and transplanted into another part of the body, such as the abdomen. This shows quite conclusively that these changes are produced through the blood stream. The effect of the hormone of the pituitary on the thyroid is not produced indirectly through the ovary for it occurs even in castrated animals. Aron demonstrated the presence of the thyreotropic hormone in the blood, the cerebrospinal fluid, and the urine.

Anderon and Collip succeeded in obtaining from the pituitary an extract which acted exclusively on the thyroid without the usual pituitary effect on the genital cells or on growth.

Jungmann and Scholler finally isolated the active substance from aqueous extracts. They showed that the thyreotropic pituitary hormone is easily soluble in water or in dilute alcohol. It is also soluble in very dilute acids and alkalis. It is, on the contrary, insoluble in concentrated alcohol, ether, chloroform and the other usual organic solvents. The substance is very thermolabile, and is destroyed at a temperature of 60 degrees. The authors found that the chemical and physical properties of the thyreotropic hormone agree closely with those of the gonadotropic hormone and of insulin. The substance may be isolated by a special technic as a dry white powder.[1]

By the recognition of the physical and chemical properties of this hormone another step in advance was made, whereupon one was in a position to investigate the question. To what extent are the anatomic changes in the thyroid gland accompanied by functional changes? In the thyroid Loeb, Loeser, and Grab found that the organic iodine decreased on an average from 13 to 1.3 milligrams per cent. On the other hand, the iodine content of the blood was definitely increased: it reached three times the value of normal blood iodine and five times the normal serum value. Substances nullifying the acetonitril poisoning reaction (the Reid Hunt reaction) in white mice were markedly increased (Grab, Oehme). Smith found that the basal metabolic rate of the animals he treated with anterior lobe of the pituitary increased 30 per cent. Verzar found that it increased up to 50 per cent. Eitel and Loeser found a progressing exhaustion of glycogen from the liver which could be stopped, according to Loeser, by insulin or the administration of sugar, but not by administration of extracts of the pancreas. The same author, with Eitel and Löher, showed an enormous increase of the acetone bodies in the blood, from 10.5 to 22.2 milligrams per cent. Loeser also showed an increased activity of the heart and an increased consumption of food in the animals he had treated with the thyreotropic hormone. Of special interest is the observation, made first by Loeb and later by Eitel and Loeser, that guinea pigs which had been treated with anterior lobe of the pituitary developed a real exophthalmos, which finding was subsequently obtained by Schockaert in ducks.

[1] The firm of Kahlbaum - Schering has already brought out this thyreotropic hormone.

If we review the experimental findings we can see that by the action of thyreotropic hormone, there results not only morphologic changes in the thyroid gland similar to those of the thyroid in Basedow's disease, but also the changes in metabolism and the other symptoms of hyperthyroidism characteristic of this disease. With all the certainty of an experiment the thyreotropic hormone of the anterior lobe of the pituitary produces the symptom-complex of hyperthyroidism and reproduces all the symptoms of Basedow's disease in man. By this a great step of progress has been made in the field of endocrinology, for now the answer to the questions of the relationships of the pituitary and the genital organs have been furnished. The pituitary, that tiny gland at the base of the brain, unstudied for a long time and in the investigation of whose function the Viennese school had such an important part (Erdheim, Aschner, Frölich and others), has now been shown by the work of American, French, and German investigators to be an organ with a number of extremely important secretory functions, particularly that of stimulating the other endocrine glands, especially the thyroid and the genital organs.

It is natural that after this stimulating effect of the anterior lobe of the hypophysis on the thyroid had been demonstrated, some therapeutic trials should be made on thyroid disease in which a stimulating effect on thyroid activity was desirable. This is the case with hypothyroidism. Such experiments were soon reported by Schittenhelm and Eisler, Eitel and Loeser, and Wachstein. It has been shown, at least by animal experiments, that it is possible to stimulate by means of the thyreotropic pituitary hormone a hypofunctioning thyroid to increased activity, in the same way that extracts which substitute for a thyroid deficiency act. A case treated by Wachstein in Eppinger's clinic may serve to illustrate the value of this new form of treatment. The patient was a woman 28 years old, who had had the classic symptoms of myxedema for two years; that is, she had pallor, thick lips, dry roughened skin, disturbances of menstruation, persistent and resistant constipation, a basal metabolic rate of —28 per cent, and increasing apathy. She received injections for five days of the Schering-Kahlbaum thyreotropic hormone. Wachstein reported: "The improvement in the clinical picture was most surprising. The patient gained 5 kilograms in weight, the menstrual disturbances and the constipation were definitely improved. The patient's skin became soft and moist; the scaling of the nails stopped. A marked change took place in the woman's psychologic make-up. She took an interest in her surroundings, was much stronger and could work again."

Further experience will show to what extent this new form of treatment will work out practically, to what extent it may replace older forms of treatment or be combined with them. One of the disadvantages of this new form of treatment is that it is effective only in those cases in which there is still present thyroid tissue that can be stimulated to normal activity. It is valueless, therefore, in congenital and postoperative athyroses, and in those cases of hypothyroidism which are for all practical purposes cases of athyroidism because the thyroid in them is functionless. But even in these cases there is the possibility of making a differential diagnosis of hypofunctioning thyroid disease by means of the effectiveness or lack of effect of the thyreotropic pituitary hormone, because the "reaction to the thyreotropic hormone in cases of hypofunction of the thyroid may give definite information about the capabilities of the thyroid parenchyma" (Wachstein).

Just as substitution therapy in myxedema corresponds to resection therapy in Basedow's disease, the stimulation therapy of hypothyroidism by the thyreotropic hormone corresponds to reduction therapy in hyperthyroid disease by roentgen irradiation of the pituitary. Because of the difficulties of approach to the pituitary, operation on the pituitary in the treatment of hyperthyroidism has not reached

the same stage of development in the treatment of essential pituitary hypofunction that it has in the cases of diseases of the thyroid.

On the other hand, there is an increasing mass of evidence of the value of radiotherapy in diseases of the pituitary which has been accumulating for almost a quarter of a century. Even though the deep position of the pituitary offered great difficulties at first in developing an effective radiotherapy, the technical progress in developing roentgen apparatus has brought us to the point that radiotherapy of the pituitary gland now presents no noteworthy difficulty. In the course of the past twenty-five years, we have become completely convinced of the absolute safety of irradiating the pituitary, because the brain surrounding the gland has been demonstrated both clinically and experimentally to be a tissue capable of tolerating with impunity even the strongest doses likely to be used in therapeutic procedures. I, myself, have in the course of ten years' experience carried out thousands of irradiations of the pituitary in hundreds of cases without ever having seen any evidence of any injury.

The indications for irradiating the pituitary are, in general, the same as for the thyroid. Hyperplastic and hyperfunctioning conditions are suitable for radiation. There are some contra-indications to the roentgen therapy of pituitary tumors, the commonest being the adenomas with or without symptoms of hyperfunction. A hyperfunction of the pituitary in the menopause which Holzknecht and I suggested in 1924 on the basis of the effect of radiating the pituitary in climacteric upsets, has been established as a definite field for radiotherapy by the demonstration of an excessive secretion of a follicle-maturing hormone by the pituitary after cessation of ovarian function in the menopause (Fluhman, Zondek, and others). Furthermore, Blas and Goldhammer have found that the increased secretion of this follicle-maturing hormone continues even after the disturbances of menstruation have been cleared up by radiation. In the light of present knowledge it seems more logical to regard these upsets as due to an increased production of the thyreotropic hormone. It has been demonstrated by numerous experiments that an increased secretion of the thyreotropic hormone of the pituitary follows cessation of ovarian function. The first of the experimental evidence was produced by Aron, and subsequently confirmed by Loeser, showing that the pituitaries of castrated animals, both male and female, contain far more thyreotropic hormone than the pituitaries of non-castrated animals. This has been shown to be true in the case of guinea pigs, chickens, and canary birds. The demonstration of an increased production of thyreotropic pituitary hormone after castration is a very important supplement to the older investigations, which showed, after castration, an increase in size and in weight of the glandular portion of the pituitary as a result of the increase in the eosinophilic cells (Fichera, Rössle and others). Similar changes have been noted not only in other varieties of animals but also in man. Windholz and the writer demonstrated similar changes in the pituitary after an intensive irradiation of the ovary.

The possibility of affecting the symptoms of hyperthyroidism by roentgen irradiation of the pituitary now is much more understandable if we keep in mind that one of the most certain properties of roentgen rays, which has been demonstrated by abundant clinical observations and animal experiments, is that of decreasing the secretory function of glandular organs.

In the light of this proven effectiveness of the roentgen rays as well as the demonstration of the relationship between the thyroid and the pituitary glands, we see the proposal to radiate the pituitary in certain cases of hyperthyroidism is justifiable from our knowledge gained both by animal experiment and by clinical observation. If these therapeutic experiments had not already been performed, they would nevertheless be justifiable on the basis of the animal experiments which

demonstrate a relationship between the pituitary and the thyroid glands. That clinical experience has preceded animal experiment and has produced noteworthy results, which later were shown to be those to be expected, is not surprising when we recall how frequently this sequence of events has occurred in other fields of medicine. By way of being fair, however, it must be admitted that in this case the results of radiotherapy were decisive and conclusive and that radiologic methods have shown their value not only in treatment but also in the field of research.

III.—THE THERAPEUTIC RESULTS OF THE PROCEDURE

(*A*) *Cases Treated with a Satisfactory Result by Irradiation of the Pituitary*

Between 1925 and 1934 (an interval of ten years), we have carried out irradiation of the pituitary in 36 cases of hyperthyroidism: ten of these were treated between 1925 and 1929, the other 26 between 1930 and 1934. Table I shows the results that were obtained.

Period	No. Cases Treated	No. with Favorable Result
1925–1929	10	4, or 40%
1930–1934	26	21, or 80%
1925–1934	36	25, or 77%

The marked difference in results of the first and second five-year period is most readily explainable by the correct selection of cases, which was facilitated by the report of Juggenberg, and secondly, by improvement in our technic of radiation, which we will discuss in detail later.

The increasing number of patients who reacted well resulted in a greater number of patients being referred for this form of treatment each year. It is hoped that the number of cases who have had pituitary irradiation with a good result will increase even more if the knowledge of the relationships between the pituitary and the thyroid which are the actual biologic foundation for this treatment is even more widely disseminated.

We may differentiate three groups of cases which responded favorably to irradiation of the pituitary.

(*1*) *Cases which were treated primarily by radiation of the pituitary.*—The following tabulation shows the results in this group:

No. Irradiated Cases	No. with Good Result
16	10 or 55 per cent

Among the ten cases with a satisfactory result, there were nine women in whom hyperthyroidism came on after the onset of the menopause. The two following case histories may serve to illustrate the course of cases which reacted favorably.

Case 1. P. S., 52 years old. Menopause at 48 years; since then, occasional hot flushes. For about four months, palpitation of the heart and sense of pressure in the chest. Frequent diarrhea: loss of 9 kilograms in weight: pulse 102: slight diffuse goiter, with bruit: blood pressure 160: basal metabolic rate +50 per cent.

Radiation of the pituitary from February 25 to 28 and from March 11 to 16, 1931. At the end of March, no more palpitation: gain of 1.5 kilograms in weight: pulse 90. In the course of a few months the patient returned to her former occupation. The body weight and the basal metabolic rate returned to their normal values. Without any further treatment, her condition has remained good until now (December, 1934), that is, for more than three and one-half years.

Case 2. P. F., 59 years old. Menopause ten years previously. After that, hot flushes, marked tremor, cardiac discomfort, frequent diarrhea. Pulse 132: basal metabolic rate +46 per cent. On May 28 and May 30, 1926, roentgen treatment of the pituitary. Since the patient felt better a week later, the treatments were repeated a few times. Further irradiation of the pituitary in October and November of the same year. Patient was very well pleased. The emotional instability, the cardiac discomfort and the general *malaise* had all disappeared. The pulse was better, but the basal rate was still increased to 35 per

cent. Therefore, she received more treatment in February, 1927. Since the basal metabolic rate was normal in June, she was not treated further, and since then she has stayed practically free of symptoms for almost nine years. Her metabolic rate has remained normal.

The clinical course of these patients who reacted favorably to irradiation of the pituitary is exactly similar to the course in those cases in which irradiation of the thyroid was given with a satisfactory result. The improvement goes in both types of treatment from the general to the particular, from the subjective symptoms to the objective signs. The nervous symptoms, the irritability, the fatiguability, sleeplessness, and headache improve first, then the body weight begins to increase and the basal metabolic rate to decrease. Then there begins an improvement in the classic triad, so that the face of hyperthyroidism is the last to clear up. The tachycardia, the goiter, and the exophthalmos disappear slowly and in some cases there is complete return to normal.

The degree of improvement was very definite in our cases because the majority (seven) returned to about the same degree of physical efficiency which they had had before the onset of the disease. Only three older women were unable to resume their work, but, at that, they were very much better than before the treatment.

The metabolic rate, which was checked up in the nine improved cases, in six returned to normal values. In three cases it persisted—a little elevated—but without causing any symptoms worthy of note, or severe enough to require further treatment. Most of the cases regained the weight which they had lost. The pulse rate generally returned to normal or persisted at only a slightly increased rate.

The improvement has lasted in one of these cases less than a year; in four it has lasted more than two years, and in four, more than five years. The oldest patient, treated in 1926, has remained subjectively free of symptoms and objectively almost free of any signs of the disease.

It seems to me that the long duration of the effect is important, that is, the infrequency of relapse. Among the ten cases that were favorably affected by irradiation of the pituitary, there was one patient who, a few months after completion of treatment, came back for more irradiation, but in this case it was the subjective symptoms alone which caused her to return. An objective recurrence was demonstrated in a 50-year-old woman about a year and a half after treatment. All the other cases have remained free of new symptoms during all the period of observation, that is, for two, three, five, and nine years. In all these cases the duration of treatment was relatively short, usually two or three months. The doses in most of these cases were about half what is usually used in direct treatment of the thyroid. I shall return later to a consideration of the technical details of this treatment.

(*2*) *Patients in whom irradiation of the thyroid failed and who were subsequently successfully treated by irradiation of the pituitary.*—The following tabulation shows the results in this group:

No. Treated Cases	No. Successfully Treated
12	9, or 75 per cent

Seven of the nine cases improved by irradiation of the pituitary were women in the climacteric.

The two following case histories may serve to illustrate the course of the disease following irradiation of the thyroid and pituitary.

Case 3. B. K., 48 years old. Operated on two years previously for a myoma; since then, amenorrhea. Since April, 1932, loss of weight, palpitation of the heart, tremor, general weakness, diarrhea. Since then, she has had medical treatment (quinin, arsenic, bromides, a diet, and about 30 short wave treatments). Since the symptoms progressed and the body weight continued to fall off, she was referred for irradiation of the thyroid, which

was carried out in January, 1933. Following that, there was a transitory improvement in her heart symptoms and in the tremor. In March her basal rate had increased. For this reason she received, in May and July, 1933, two series of three treatments of the pituitary. The patient's symptoms all cleared up. Her condition as checked up in October, 1934, still remains good.

The effect which the various methods of treatment had in her case is well illustrated by the basal metabolic determinations, done by Dr. Liebesny, in the Physikalischmedizinische Abetilung des Wiener allgemein Krankenhaus. He had no knowledge of the change in treatment technic.

(*a*)	Period of medical treatment (May–Dec., 1932)		
	1931	August 8, basal metabolism	62.8%
		September 7, basal metabolism	59.3%
	1932	May 10, basal metabolism	60 %
		June 23, basal metabolism	57.3%
(*b*)	Period of radiation of the thyroid (Jan.–March, 1933)		
	1933	January 13, basal metabolism	47.1%
		March 13, basal metabolism	59.8%
(*c*)	Period of radiation of the pituitary (April–July, 1933)		
	1933	July 20, basal metabolism	43.5%
		October 30, basal metabolism	25.5%
	1934	March 9, basal metabolism	6.1%
		October 31, basal metabolism	2.0%

Case 4. Z. L., aged 44. Amenorrhea of a year's duration. Loss of 14 kilograms in six months: lack of ambition: loss of appetite: anxious state: palpitation of the heart. For many years she had had a diffuse goiter. Pulse 102: marked tremor: slight exophthalmos: basal rate 50 (Dr. Güdemann). Three treatments of the thyroid in June and July, 1931. In spite of this and a vacation in the country a further loss of 4 kilograms in weight. Onset of diarrhea; increase of the tremors. Therefore, in September and October, three treatments of the pituitary: condition at the end of October showed no further decrease in weight; felt better; had less palpitation and difficulty in breathing. Another treatment of the pituitary in November. In June the basal rate had increased to only 29 per cent. Patient had gained 5 kilograms; looks very well, and her symptoms are no longer annoying. Pulse between 84 and 90. In December, 1933, a check-up showed the basal rate to be 20 per cent, pulse normal, and weight normal. In April, 1934, her basal rate was 19 per cent, pulse 78. Patient is fully capable of resuming normal activities.

The course of events in this group which reacted favorably agrees completely with that following irradiation of the pituitary, as a primary procedure. This is true also, apparently, in regard to the end-result. There is, for example, in this group a patient treated in 1925 by irradiation of the pituitary for thyroid disease, who has enjoyed good health for the ten years since then without any interruption whatever. If one reviews this group one gets the impression that these cases obtained the same result that they would have if they had been treated with pituitary radiation primarily. The patients noticed this themselves and often expressed this opinion. One of them expressed herself somewhat drastically but yet humorously, "To me, as a lay woman, it is quite puzzling that a disease which everyone knows is in my neck can be cured by treating my head. Can it be that the goiter which shows up in my neck is due to some defect in my head?"

The beneficial results in the cases in this group are more important than those in the first group, which were improved by irradiation of the pituitary and which show the fundamental effectiveness of pituitary irradiation, while the cases in the second group serve to emphasize the superiority of irradiation of the pituitary over treatment of the thyroid. The fact that cases which could not be improved by treatment of the thyroid could be improved by treatment of the pituitary, it seems to me, is one of the greatest advantages of this newer procedure.

(*3*) *Cases that were partly improved by irradiation both of the thyroid and of the pituitary.*—The following tabulation shows the results in this group:

No. Cases Treated	No. with Favorable Results
8	6, or 75 per cent

Among the six patients who reacted favorably, there were three women in the climacteric. There was also one man in this group. The cases in this group are characterized by the fact that irradiation of the thyroid was effective in producing a favorable, and in some cases life-saving, effect, but to the point that further irradiation of the thyroid was unlikely to produce any improvement in the objective condition. Irradiation of the pituitary cleared up completely all residual signs of the disease.

Two illustrative case histories are given.

Case 5. O. J., the patient, a man 50 years of age, had lost 20 kilograms in the past three years, most of it in the last three months. Marked weakness; marked tremor; cardiac symptoms; air hunger; exophthalmos; positive Möbius and Gräfe signs; enlargement of the right lobe of the thyroid; bruit; pulse 120; basal rate increased to 98 per cent.

Irradiation of the thyroid was administered from February to May, 1931. Following that, there was marked improvement. Patient left the hospital and went back to work part-time. However, in November of the same year the basal rate was still increased to about 50 per cent and the pulse varied around 100. These findings did not change after further irradiation of the thyroid, in November, 1931, and in January, 1932. On February 23 the basal rate was 48.9 per cent. Not until irradiation of the pituitary was carried out in September, 1932, was there a decrease of the basal rate to 25 per cent, and after that a decrease to normal values. Table II shows the figures of the basal rate.

(*a*) Period of irradiation of the thyroid (March 2, 1931, to April 13, 1932)

1931	March 1, basal metabolic rate	98%
	November 17, basal metabolic rate	49.3%
1932	February 23, basal metabolic rate	48.9%
	April 2, basal metabolic rate	49%
	May 27, basal metabolic rate	41.9%
	September 10, basal metabolic rate	43.9%

(*b*) Period of irradiation of the pituitary (September 16 to 21, 1932; July 7 to 23, 1934)

1932	December 2, basal metabolic rate	22.3%
1934	July 6, basal metabolic rate	25.5%
	September 1, basal metabolic rate	normal

Case 6. P. R., aged 27 years. Onset of symptoms six months previously with headache, lassitude, loss of appetite, loss of weight, falling of the hair, enlargement of the thyroid, exophthalmos, delayed menstruation. Patient came for treatment in March, 1934. In spite of repeated treatment of the thyroid, improvement was slow: only with great difficulty did we succeed in avoiding crises. Patient refused operation. Gradually we succeeded in getting her into better shape by a combination of climatotherapy and general medical measures. All symptoms improved: the basal rate which had been 73 per cent, decreased, but the patient had to receive further radiotherapy because the basal rate started to rise again, from its normal value. When it had gotten up to 26.7 per cent in November, 1932, irradiation of the pituitary was carried out. After the first treatment in November the basal rate was unchanged, as it was in January, 1933; but in March it went down to 7 per cent; in December, 1934, it was 2.5 per cent—in other words, it persisted at a normal level.

In this group there were two recurrences. These were manifest not in the clinical symptoms but in the basal rate. After it had been brought down by irradiation of the thyroid and had remained at a certain level and after a second drop had been produced by irradiation of the pituitary so that it was practically normal in both these cases, it rose again to about the same point at which it was before irradiation of the pituitary.

Summing up, one may say, of 36 cases that were treated for hyperthyroidism either primarily by irradiation of the pituitary or by pituitary irradiation after irradiation of the thyroid had produced a poor result or only a partial one, 25 cases (77 per cent) were favorably influenced. These results have lasted for years in most cases. They were obtained by lower doses and in less time than they could have been obtained in the average case by irradiation of the thyroid.

(B) Cases in which Irradiation of the Pituitary Failed

In the 36 cases that had irradiation of the pituitary, no results were obtained in 11 cases (23 per cent).

These cases may be classified as follows:

Group 1 (primary pituitary irradiation) 16 cases	6 failures
Group 2 (hypophyseal irradiation after failure of thyroid irradiation) 12 cases	3 failures
Group 3 (pituitary irradiation after partial success with irradiation of the thyroid) 8 cases	2 failures

From a theoretical as well as practical point of view the cause of these failures is of much more interest than their numbers, for by the recognition of the cause it may well be possible to avoid similar failures or at least minimize them in the future.

In some of these cases the cause for failure was undoubtedly too small doses. I will come back to this subject later on. Probably the main cause of failure was incorrect selection of cases for such treatment. In this regard we have a direct and indirect confirmation of the work of Juggenberg, for we demonstrated also that among the women who reacted poorly the great majority were in the climacteric, and among the cases that showed no result after irradiation of the pituitary, the greater part were youngish individuals. Among the 11 cases in whom irradiation of the pituitary had no effect, six women and one man were less than forty years old at the onset of their disease.

Of interest also is the fact that of six cases not favorably influenced by primary pituitary irradiation, two cases were later on practically cured by irradiation of the thyroid. If we take into consideration that in three other cases in Group 2 and in two cases in Group 3, irradiation of the pituitary, as has been mentioned, accomplished little more than had the irradiation of the thyroid, it appears that we are not in a position to state that pituitary irradiation is better than treatment of the thyroid, but that each type of treatment has its own special field in which its effectiveness is greatest.

This fact should be emphasized both for theoretical and for practical reasons, for the results of the animal experiments we have cited might give the impression that each case of hyperthyroidism is of a pituitary origin, and for that reason any method of treating the thyroid is beside the point. Such an idea should be emphatically rejected.

It is also clear that a well done resection of the thyroid, even though it is not the standard method, is still the most radical therapeutic method for the treatment of hyperthyroidism. And even though this procedure does not get at the cause of the disease, it leaves the organ, as has well been shown by animal experiment, incapable of developing a stage of hyperthyroidism. It, therefore, seems possible to modify or even supress the development of hyperthyroidism by decreasing the activity of the thyroid gland by radiotherapeutic measures; but whereas the surgeon has to confine his efforts to the thyroid in the treatment of hyperthyroidism, because any operation on the pituitary is a much harder surgical procedure than operation on the thyroid, one can treat roentgenologically both the thyroid and the pituitary with comparatively little risk. If conditions are such that the thyroid is whipped up to increased activity by the pituitary, one will select the latter gland for radiologic treatment, and in those cases, especially in older women, in which after resection of the thyroid a recurrence has taken place, the thyroid will not be treated again, but the pituitary.

In those cases in which there is little evidence for suspecting an involvement of the pituitary, in addition to the thyroid, one will, naturally, irradiate only the thyroid.

Human hyperthyroidism, unlike experimental hyperthyroidism, is not always of a pituitary origin. In the human the noxious agent, perhaps through the nervous system, attacks the thyroid directly (Eppinger, Bauer and others). Against this idea the objection might be raised that there are inter-relationships between

the glands of internal secretion, which may reciprocally increase the activity of these glands, or decrease them. Since it has been shown that an increased activity of the pituitary results in an increased activity of the thyroid, one might postulate that, *vice versa*, hyperactivity of the thyroid should lead to increased activity of the pituitary; then the damaging agent arising in the thyroid affects the pituitary secondarily and involves it in hyperthyroidism. This is not the case, however. One of the theoretical and practical results of the modern study of endocrinology is that these inter-relationships of the endocrines do not always supplement each other, but may often, on the contrary, oppose each other. According to this idea the pituitary is a motor of the sexual function and a stimulus of the thyroid functions. The reverse does not hold true. It has been established for a long time that the genital glands suppress the activity of the pituitary. The same function has been reported for the thyroid by Loeb, who started with the well-known fact that after resection of the thyroid the portion remaining undergoes a compensatory hypertrophy. But a hypertrophy does not take place if, after resection, the animal is given thyroid extracts. Loeb concluded, therefore, that the secretion of the thyroid had among its various functions that of holding the secretion of the organ constant at a certain level. If the thyroid is producing less hormone as a result of resection, the activity of the gland is stimulated by the lack of hormone and the gland hypertrophies. If, however, thyroid is administered, there is no need for hypertrophy and it does not occur. Another thing associated with the regulation of the thyroid activity by its own secretion was discovered by Loeb, namely, that the action of the anterior lobe of the pituitary on the thyroid is less, or may even be absent entirely, if thyroid extracts are given. From these interesting observations it seems that, whereas the thyreotropic and the thyreogenous hormone effect peripheral tissues in the same way, they have an opposing action on the thyroid—the thyreotropic hormone stimulates, the thyreogenous hormone depresses the thyroid.[2]

Of special interest in the mechanism by which the thyrogenous hormone exerts its depressant effect on the thyroid, Kuszinsky showed that the depressant effect of the thyroid hormone results through the agency of the pituitary, and that the thyroid hormone decreases primarily the activity of the pituitary. This was demonstrated in the following way: The thyroid of a guinea pig was activated by transplantation of pituitary tissue from rats. If the rats were previously treated with thyroid, the thyroid-stimulating action of their pituitaries was lacking. The pituitary of animals to which thyroid substance had been given, therefore, produced no thyreotropic hormone, or at least a greatly decreased amount, compared with the pituitary of a normal animal.

There seems, therefore, to be the same relationship between the pituitary and the thyroid as between the pituitary and the genital cells, for the administration of folliculin depresses the formation of prolan just as the administration of thyroid substance hinders the production of thyreotropic hormone. On the other hand, administration of prolan accelerated the production of folliculin in the ovary, just as administration of thyreotropic hormone stimulates thyroid activity.

These interesting experiments explain

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[2] Many well known facts seem to confirm this idea. In Trendelenburg we find the following: "After administration of thyroxin or of thyroid, the thyroids of mammals in general are smaller, denser, more anemic, the colloid is increased, stains well, the epithelial cells are flatter, the number of mitoses is decreased, there is degeneration of the epithelium, disappearance of the follicles, and the formation of colloid cysts. If dogs whose thyroids show epithelial hyperplasia are given thyroid, there occurs after a short time a transformation of the hyperplastic gland into a colloid gland. The increased height of the acinar epithelium and the decrease of colloid content and the compensatory hyperplasia, the increase in mitoses, and lack of colloid seen after partial removal of the gland, are lacking. The follicles are in a resting state, that is, the epithelium is flat, the number of mitoses is low, and the colloid is viscous." (Vol. II, page 165.)

the apparent discrepancy between the old and the new studies on the relationships between the thyroid and the pituitary. The older studies, as has been mentioned, seemed to show an antagonism between them, while the more recent investigations seem to show a synergistic relationship between them. These contradictory conclusions are the result of the fact that in earlier times it was easier to perform an extirpation of the thyroid than of the pituitary, which excluded, therefore, comparable studies on this organ. These experiments on the thyroid seemed to point to a stimulating effect on the pituitary, so it was concluded that hyperfunction of the thyroid resulted in a hypo-activity of the pituitary. But in later times, when the surgical technic of hypophysectomy had become more perfected and the effect of the pituitary on the thyroid more carefully studied, it appeared, to the contrary, that an atrophy and not a hypertrophy of the thyroid resulted. Then finally, when the pituitary hormone were isolated, it was found that among its properties was one which stimulated the function of the thyroid. As applied to human pathology, these findings lead to the following results:

If some noxious agent arises in the thyroid, there results from the hyperactivity of the thyroid a decrease in the activity of the pituitary, in which case roentgen irradiation of the pituitary is strictly contraindicated. There is the same contraindication if the thyroid disorder, through over-production of toxins, results in some ovarian damage or upset. In this case the tendency to over-production of thyreotropic hormone caused by the suppression of ovarian activity opposes the suppression of pituitary activity caused by the hyperactive thyroid. The increased activity of the thyroid can be suppressed in such a case by operative reduction of the size of the gland or a radiotherapeutic reduction of its function.

If, on the other hand, the noxious agent arises in the pituitary and by it there results an over-production of thyreotropic hormone, or hyperactivity of the pituitary, then in this case an operation on or a radiation of the thyroid is hardly indicated, but radiation of the pituitary, as it attacks the physiologic etiology of the trouble.

It is of the greatest importance that the two groups can be kept distinct without any extensive investigation merely by establishing the age of the patient and by taking an accurate clinical history. If the patient is a young one, we are dealing with a primarily thyreogenic case; if, on the other hand, the patient is older and the hyperthyroidism began with the menopause, we are dealing with a primary pituitary and secondary thyrogenic case. It is quite important in the human to distinguish the two types of hyperthyroidism, a state of affairs that does not exist in the case of animal experiments.

Another point is useful in distinguishing spontaneous hyperthyroidism in man from experimental hyperthyroidism in animals. In animals, hyperthyroidism can be brought on experimentally in every case, but hyperthyroidism occurs in man in only a low percentage of cases. This fact is not very strange when we remember that there are great differences between the two types of animals. Thus Loeb has found that the thyroids of guinea pigs react less intensively after the administration of thyreotropic hormone than do the thyroids of rats. There are differences between various individuals just as there are differences between various kinds of animals. This fact can be explained only on the basis of the ideas of Chvostek, J. Bauer, and Eppinger, that there is a constitutional disposition to some diseases. It so works out, therefore, that whether hyperthyroidism occurs in a person or not depends on the inter-relationship and balance of his various organs and tissues.

In regard to the influence of the constitution on the course of the disease there is another noteworthy difference between man and animals. In animal experiments, the course and development of hyperthyroidism is quite uniform; in man, on the other hand, hyperthyroidism is different in different patients, because different

symptoms result from differences in reactibility to the same stimulus, so that there results a varying intensity of the separate symptoms which go to make up the varying symptom-complex of hyperthyroidism.

One more difference between experimental and human hyperthyroidism should be mentioned. It is a fact that certain symptoms which occur regularly, or, at least, frequently, in spontaneous hyperthyroidism, and which are characteristic of the disease, are either lacking completely in experimental hyperthyroidism (such as, for example, loss of weight and diarrhea), or are less marked (for example, tachycardia). This deviation warns us that we must be extremely careful in applying the findings in one type of animal to another, or from animal to man, and especially in applying them from one human being to another. Animal experimentation serves only to reproduce under exact conditions some of the phases of a disease in question so that some of its relationships may be understood more exactly. With such a point of view we have considered the favorable effect of roentgen radiation of the pituitary on hyperthyroidism. The animal experiments of the past few years have served to clarify that which we knew empirically was true in man. In the case of man, we knew the head and tail, and animal experiments found for us the body.

(C) Apparent Exceptions and Obscure Cases

Among the 23 cases in which pituitary irradiation produced a favorable result, there were six in which the otherwise valid indications by which radiation of the pituitary in women in the climacteric with hyperthyroidism was effective and in younger persons ineffective, no longer held true.

One exception to this rule which seemed to be well established biologically is that of sex. We have, as has been mentioned, observed a man (Case 5), 50 years old, in whom irradiation of the thyroid was a life-saving measure, it is true, but in whom the basal metabolic rate established itself at about 40 per cent in spite of repeated irradiation of the thyroid. Radiation of the pituitary at this stage produced an uncontrovertible drop of the basal rate to normal. From this, we might draw the conclusion that radiation of the pituitary should not be reserved for old women, but that old men should be included. Here, further experience is very desirable.

Two other cases were exceptions from the standpoint of age. One woman was 35 at the onset of her disease, the other 27 years old. In the first patient the state of affairs is a bit clearer than in the second case, because in the former menstruation was absent during the period in which irradiation of the thyroid produced no result whatever. When irradiation of the pituitary was started for this reason her menstruation began again, and there followed a slow but definite improvement in her hyperthyroid symptoms which has lasted more than five years. Conditions are more obscure in the second patient whose history is given under Case 6 above. In this case irradiation of the thyroid had had sort of a half satisfying effect. The basal metabolic rate did not return to normal until four years after the beginning of radiotherapy. In three months it rose again. During the whole time the patient menstruated regularly at somewhat longer intervals than normal and the flow was decreased in amount. Whereas in several other similar cases irradiation of the pituitary had had no definite effect, in this case the recidivity was promptly cleared up by irradiating the pituitary, and her general condition has remained quite satisfactory for more than four years. The two cases, however, have much in common—the long duration of the disease. The first case, 35 years old at the time roentgen therapy was given her, had already been suffering from a definite Basedow's disease for three years and had had ligation of the thyroid arteries. In the second case it took roentgen therapy almost three years to produce a result before radiation of the pituitary was carried out. Perhaps, there-

fore, in long-standing disease there occurs a change in the pituitary of young individuals also, which may explain the favorable effect of radiating the pituitary. In this regard, further experiment and experience are very desirable.

Three other young women were benefited by irradiation of the pituitary without there being any reasonable explanation for it. The patients all menstruated, perhaps less profusely and more irregularly than before the onset of the disease. In these cases the disease had been present for only a few months. Without being able to prove it, we might adopt the explanation that they were not improved by irradiating the pituitary but by the climatotherapy and the medical means with which they were treated. These points need further investigation.

IV.—THE TECHNICAL ASPECTS

Since the anatomic structure of the anterior lobe of the pituitary is similar to that of the thyroid, we have irradiated the hyperactive pituitary in the same way we treat a hyperactive thyroid. I have described the technic in detail in the presentation I made at Lüttich in 1930. We treat the thyroid through an anterior and two lateral fields at two-day intervals. In the same way the pituitary is treated through a frontal and two temporal fields. The dose on the skin, as it is in the case of the thyroid, is 200 r. Because of the fact that the thyroid is quite superficial and the pituitary is located at a depth of 7 cm. on the average, and so the effective dose is only about 40 per cent of that effective in the skin, the three fields are treated for a second time after eight days. The other treatment factors are 0.5 mm. zinc filter, 30 cm. distance, 170 kilovolts.

In about 50 per cent of the cases irradiation carried out in this way has produced a satisfactory result. There is no doubt that the dose effective in the pituitary is definitely lower than that which is usually effective in the treatment of diseases of the thyroid.

If the basal metabolic rate or the pulse deviate greatly from normal at the end of eight weeks, we repeat the radiation series. We have given a third series only in case of recurrence.

Aside from headache, which occurs now and then on the day of treatment, we have never seen any upset from irradiation of the pituitary. This agrees perfectly with what has happened in the thousands of pituitary treatments which I have given for various reasons to hundreds of patients during the last ten years. This roentgenologic technic is perfectly safe and without any danger whatever.

THE RÔLE OF THE FORCE OF GRAVITY IN THE PNEUMOTHORAX CAVITY

INCLUDING A DISCUSSION OF SELECTIVE COLLAPSE[1]

By EPHRAIM KOROL, M.D., Veterans' Administration Facility, *Lincoln, Nebraska*

IN THE normally expanded lung, the apex is partly relieved of the weight of the lung base by the expansibility of the numerous air vesicles which are in communication with the atmosphere. Traction on the lung at any one point is immediately satisfied by the inrush of air from the outside (1). Furthermore, the atmospheric pressure holds the lung against the chest wall, counteracting the pull of gravity. In the upright position, the pull exerted on the apex by the weight of the lung is but two centimeters of water greater than at the diaphragm (2). If the lung is separated from the chest wall by the entrance of air into the pleural cavity, the force of gravity is given full play. The lung drops by its weight and sinks downward and inward as far as its attachments at the hilum will permit. The several lobes, being fixed to the bronchi, which vary in length and direction, separate out and drop away from each other. The lobes, normally indistinguishable from each other, become plainly visible on x-ray films taken after the induction of a pneumothorax. The interlobar fissures are wide open, and the incidence of pleural exudate and of spontaneous pneumothorax is greater in cases treated by artificial pneumothorax than in cases not so treated.

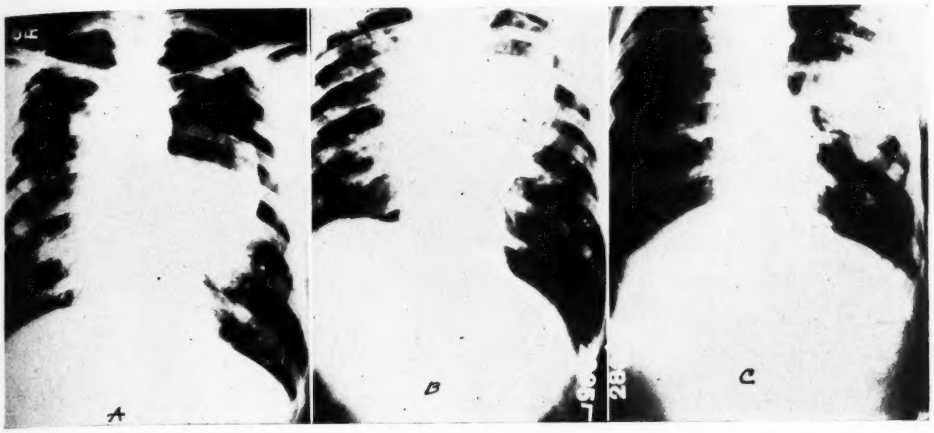
The partly collapsed lung is freely movable, and during changes of posture shifts around much like the clapper of a bell, to use the apt simile of Rist (3). Upon changing from the recumbent to the erect position, the lung may be felt to strike against the palpating hand. By percussing in the different positions of the body, areas of shifting dullness are found, so that hydropneumothorax is simulated (4). In the recumbent position, no breath sounds can be heard over the front of the chest, while in the erect position harsh breath sounds appear.

If the collapsed lung be adherent to the chest at one or more points, then the freely movable portion of the lung tugs on the adhesions, particularly during forced respiration or physical exertion, and during changes of posture, thus bringing about enlargement of cavities, tears in the lung, and torsion of blood vessels. The traction on the adherent lung is greater if the adhesions involve the mediastinum or the diaphragm, as the weight of the heart and of the abdominal viscera is added to the weight of the lung.

Massive Atelectasis in the Pneumothorax Lung.—The pull of the dangling lung is exerted chiefly on the large bronchi, particularly on the bronchus of the upper lobe which is pulled downward and inward, away from its natural course. The upper lobe bronchus is not infrequently kinked to such an extent that its lumen is occluded and the entire lobe becomes atelectatic (Fig. 1). This is more likely to happen if the lung contains a pneumonic area or a cavity holding pus or blood, rendering the lung heavier than usual. The left upper lobe is more vulnerable in this respect as it is equal in weight to the right upper and middle lobes combined, but is supported by a single bronchus.

In cases of bronchial occlusion and atelectasis of this nature, there usually develops fever, unproductive cough, and general malaise, all being symptoms of retained secretions. On physical examination we have observed an area of tubular breathing between the spine and the scapula, on the treated side. The roentgenogram discloses a completely airless lobe, which appears very opaque, in marked contrast with the other partly inflated lobes suspended in the pneumothorax.

[1] Published with the permission of the Medical Director of the Veterans' Administration, who is not responsible for the conclusions drawn or the opinions expressed by the author.



Bilateral pneumothorax. A massive atelectasis of the left upper lobe; the left lower lobe is air-bearing and can be seen both above and below the limits of the upper lobe, which has contracted toward the hilum.

Fig. 1-*A*. Roentgenogram taken with the patient standing. The lungs have dropped downward and inward and rest on the diaphragm. There is an adherent cavity in the right apex.

Fig. 1-*B*. Roentgenogram taken with the patient lying on the right side—film made at the same sitting as in Figure 1-*A*. On the right side, the air has risen toward the mediastinal region and is invisible. On the left side, the lung has shifted apicalward, displacing the air toward the diaphragm.

Fig. 1-*C*. Roentgenogram taken with the patient lying on his left side. The left lung is now at the bottom of the pleural cavity; the air is in the apical and mediastinal regions. The right lung has moved upward, displacing the air toward the diaphragm. The outlines of the lower lobe are reinforced with pencil.

What is the fate of the atelectatic lobe, and what bearing has this complication on the result of the treatment? Steiger (5), who describes three such cases, states that the atelectatic lobe undergoes fibrosis and prevents the re-expansion of the lung at the termination of the therapeutic pneumothorax. Surgical collapse measures have to be employed in order to bring the chest wall in contact with the crippled lung. In a case described by Wang and Van Allen in the April, 1934, issue of this journal, the atelectatic right upper lobe failed to expand after the pneumothorax was abandoned. Following a phrenicotomy the middle and lower lobes filled the entire hemithorax. De Winter and Sebrechts (6) described a case treated by bilateral pneumothorax in which both upper lobes became atelectatic: the patient recovered and the upper lobes re-expanded. It has been my observation that the bronchial lumen may be re-established in these cases. After the pneumothorax has become complete and the blood and mucus have been expressed from the treated lung, the weight of the lung is much reduced; the strain is removed from the kinked bronchus and its lumen becomes patent again.

Obstructive Emphysema in the Pneumothorax Lung.—If the bronchus be twisted but its lumen not completely obliterated, the stenosis may act in a ball-valve manner, leading to obstructive emphysema and to enlargement of cavities in the affected lung. In such cases it may prove difficult to maintain the pneumothorax even by large and frequent inflations—the "pneumothorax insatiable" of the French writers (7). Emphysematous blebs are commonly seen in the pneumothorax lung, and have been described during bronchoscopic observations as well as during postmortem examination (8 and 9). Occasionally these blebs have ruptured into the pneumothorax cavity (10).

Enlargement of Cavities in the Pneumothorax Lung.—Many observers have reported the enlargement of cavities after the institution of pneumothorax treatment. Siems (11) observed the annular shadows, both of emphysema and of

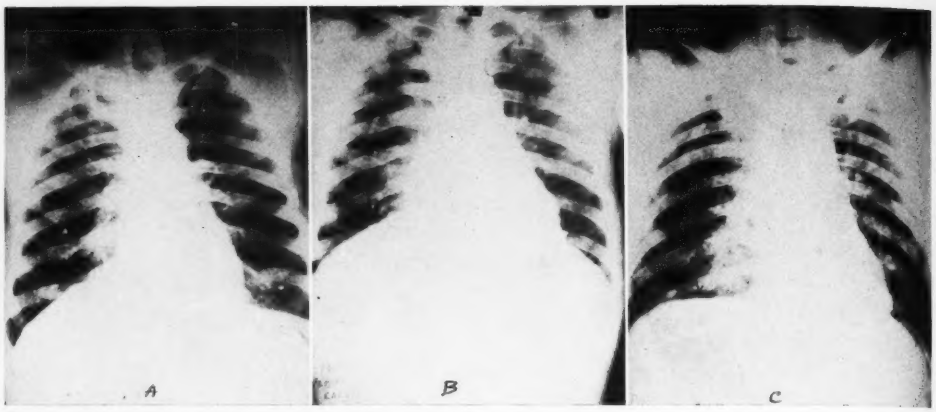


Fig. 2-*A* Roentgenogram taken just prior to induction of pneumothorax. There is extensive tuberculosis in the right upper lobe; no cavity is visible.

Fig. 2-*B*. Roentengogram taken after inflation of 500 c.c. of air, with the patient sitting. The lung has dropped downward and inward. There is a large cavity opposite the first anterior interspace. The lung rests on the diaphragm; there is air in the apical region.

Fig. 2-*C*. Roentgenogram taken same day as Figure 2-*B*, with the patient lying on his face—the foot of the bed is elevated 6 inches. The lung has moved toward the apex; there is no cavity discernible. There is air above the diaphragm.

tuberculosis, to first appear or to enlarge after the induction of pneumothorax. He is inclined to believe that the enlargement is more apparent than real, and might be explained by the altered radiability of the chest contents after the inflation of air. He admits, however, that kinking of the draining bronchus may be a factor.

Alexander (12) thinks that the x-ray appearance of the line of demarcation is altered but that there is no actual enlargement of the cavity in these cases. In Slavin's (13) cases, the cavities admittedly enlarged after the artificial pneumothorax was induced; they diminished or disappeared after phrenic paralysis was added. As there were extensive adhesions in Slavin's cases, it is logical to assume that the diaphragmatic activity caused the enlargement of the cavities by tugging on the cavity walls. Gilbert (14) recognizes the rôle of bronchial stenosis. In one of his cases the progressive enlargement of the cavity finally led to its rupture into the pneumothorax cavity. He found the pressure higher than atmospheric in these cavities. Gulbring (15) described three cases in which the cavities enlarged under pneumothorax treatment, due to bronchial stenosis. In one of the cavities the pressure was so high that perforation occurred. Geszti (16) and Trojan (17) also recognize that kinking of the drainage bronchus leads to cavity enlargement and symptoms of sepsis after induction of pneumothorax. There is fever, pain in the chest, and increased cough, due to retained secretions. On physical examination, there is stridulous breathing or signs of catarrhal bronchitis with sibilant râles. The roentgenogram shows, in addition to the eccentric enlargement of the cavity, the undrained sputum with the familiar fluid level.

We have found that in some of these cases the size of the cavity varies in the different body positions. In the erect position, the bronchus may be strained by the weight of the lung or by the weight of the heart or of the abdominal viscera, acting through basal adhesions; this strain may be relieved in the horizontal position and the valve action may be suspended. The cavity thus decreases in size in the horizontal position (Fig. 2).

The Rôle of Gravity in the So-called Selective Collapse.—In pneumothorax refills, the air is generally admitted through the uppermost point on the chest with the

patient lying on the untreated side. This site of operation is selected particularly if selective collapse is aimed at, as the operator tacitly expects the air bubble in the chest to rise to the top; in this way, wounding of the lung by the needle is avoided. The injected air will remain at the site of entry as long as the patient remains quiet and motionless. Soon, however, the air and the movable underlying lung rearrange themselves in accordance with the laws of inertia and gravity, the heavier lung sinking toward the bottom of the chest, and the air rising to the top. As the roentgenographic examination is universally made with the patient in the erect position, the illusion is obtained that the air has accumulated above the diseased portion of the lung, which is generally in the upper lobe. Some practitioners are prone to the opinion that there is a providential selectivity on the part of the air bubble for diseased lung. One enthusiast (18) has expressed himself as follows: "So invariable is this property of the air to accumulate over the diseased tissue, that I conceive of pneumothorax being induced as a measure to determine whether lung disease is present and where." We do not know whether this diagnostic measure has been practised, but we expect that the resulting pneumothorax would always be apical in location, with the patient in the erect position. We find that in traumatic pneumothorax and in spontaneous pneumothorax, unassociated with manifest lung disease, gravity also governs the location of the air bubble. In these cases, when films are made in the erect posture, the pneumothorax is always of the "selective" type.

It is curious that the several American writers on the subject of selective collapse have uniformly ignored the factor of gravity. Some of them claim that, in tuberculosis of the lower lobe, the air will accumulate at the lung base, leaving the apex expanded, but we fear that these writers were guided more by good hopes than by careful observation. After an extensive review of the literature, I was able to find but one illustration of a purported selective collapse in a basal lesion (19). Upon inspection of the roentgenogram, it becomes plain that there were extensive adhesions preventing the upper lobe from collapsing; high pressures were used so that the heart is pushed away and the diaphragm is flat. This was not a selective collapse but a forcible compression of the lung base.

CONCLUSIONS

1. Under normal conditions, the lung is but slightly stretched by its own weight, largely due to atmospheric pressure holding the lungs against the parietal pleura in opposition to gravity. The lung is also protected from excessive stretching by the heart and abdominal viscera. After the induction of pneumothorax, the lung sinks toward the bottom of the pleural cavity by its own weight. In case of mediastinal or diaphragmatic adhesions, the heart and abdominal viscera exert traction on these adhesions, sometimes tearing them.

2. The lung moves about freely in the pneumothorax cavity during changes of posture. In films taken in the erect position, the air bubble appears on the top of the lung, producing an illusion of selective collapse; in films made in the knee-chest position, the air readily shifts toward the diaphragmatic region in accordance with the laws of gravity and inertia.

3. The weight of the lung may kink one or more of the lobar bronchi, producing massive atelectasis. If the bronchial lumen is but partly occluded, there will result obstructive emphysema and enlargement of the cavities in the lung treated by pneumothorax.

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RETROGRADE PYELOGRAPHY[1]

A DESCRIPTION OF THE ROUTINE PROCEDURE AT JEFFERSON MEDICAL COLLEGE HOSPITAL

By THEODORE R. FETTER, M.D., *and* R. MANGES SMITH, M.D., *Philadelphia*

From the Urologic and X-ray Departments of the Jefferson Medical College Hospital

THE method of procedure of retrograde pyelography in Jefferson Hospital has not varied since 1912, when Professor Willis F. Manges first described the advantages of injecting the opaque solution into the renal pelvis under fluoroscopic control. Every retrograde pyelographic study at Jefferson Hospital since that date has been done under careful fluoroscopic control. The term "pyeloscopy" is used for the sake of brevity. Dr. Manges in his paper on this subject says: "Pyeloscopy is a preliminary to pyelography, and adds, we believe, distinctly to the comfort of the patient, as well as to the safety and accuracy of the entire procedure." This statement is just as applicable to-day as it was then. Excretion urography has not supplanted retrograde pyelography as some would have us believe, but has made retrograde pyelography the more accurate procedure in roentgenologic diagnosis of renal pathology. The highest degree of efficiency of retrograde pyelography can be attained only by practising pyeloscopy.

Fig. 1. Roentgenogram showing the catheter to be angulated in the ureter, due to a break near the tip.

Fig. 2. Roentgenogram showing both ureters catheterized and in a very bad position. Pyeloscopy was not employed either before or during injection.

Dr. Manges' reasons for asking to observe the injection fluoroscopically were

[1] Presented before the Radiological Society of North America, at the Twentieth Annual Meeting, at Memphis, Tenn., Dec. 3–7, 1934.

Fig. 3. Photograph showing technic of injection under fluoroscopic control on an ordinary Potter-Bucky diaphragm table.

Fig. 4. Photograph showing technic of making film with the fluoroscopic tube.

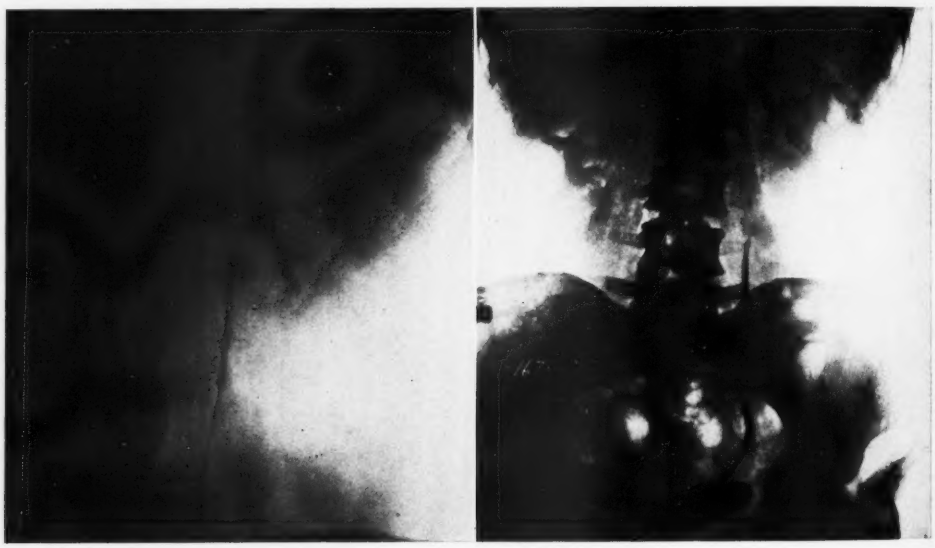

Fig. 5. Small films made with fluoroscopic tube. Fig. 5-*A* (*left*). Kidney completely filled. Fig. 5-*B* (*right*). Kidney partially filled on a 14 × 17 Potter-Bucky diaphragm film.

that frequently they were unsuccessful in obtaining satisfactory pyelograms—patients were having a great deal of pain from over-distention—and that because of frequent re-examination the work of his department was unnecessarily increased. We may add that if excretion urography does not give us the required information, we look to retrograde pyelography as the final court of appeal. The advantage of pyeloscopy in such cases remains undisputed.

There should always be a preliminary radiographic examination of the entire urinary tract. The films should be of such quality as to show the outline of the kidneys—their size and position—and any calculus or other density in the region of the kidneys, ureters, or bladder.

Previous to the day of the examination,

the patient is instructed to partake of a light supper, and later in the evening one ounce of castor oil. On the morning of the examination, a simple soap-suds enema is administered. No breakfast is served. The preliminary radiographic examination is then made.

There have been quite a few cystoscopic tables that are equipped with the Potter-Bucky diaphragm and x-ray tube for making pyelographic exposures. Recently, there has been constructed a cystoscopic table which permits fluoroscopic observation of the injection. We have such a table at Jefferson, and it is used frequently. We still adhere, however, to the x-ray table that combines the advantages of the fluoroscope and Potter-Bucky diaphragm, in any position from the Trendelenburg to the erect.

There is no real objection to removing the patient from the cystoscopic table to the fluoroscopic one with the catheters in the ureters after the cystoscope has been removed. The catheter rarely causes pain unless it is inserted too far, in which case it may curl in the renal pelvis or enter a calyx and cause distinct discomfort. In a few instances the catheter will have a tendency to slip out of the ureter; such cases are rare. Seldom is it necessary to repeat cystoscopy because the pyelogram is unsuccessful, or to repeat cystoscopy because the catheter is in the bladder and not in the ureter, after the patient is moved to the fluoroscopic room. We know of only two such cases during the last five years. In one case the patient presented the interesting anomaly of double kidneys and double ureters on both sides, with an obstruction on each side at the lower end of one of the ureters. Catheters were passed into three ureteral orifices; two encountered no obstruction, and the third passed for a distance of 3.5 centimeters. The cystoscope was then removed, and the patient moved to the fluoroscopic room where we noted one of the catheters in the bladder. We were never successful in getting a retrograde pyelogram of this one kidney. The cystoscopic x-ray table was employed with no better results. Undoubtedly, excretion urography in this type of case is invaluable.

Fig. 6. Photograph showing fluoroscopic examination of patient in an erect posture.

The second case was one of extensive tuberculous pyonephrosis, with bladder involvement. The cystoscopy caused the patient extreme discomfort. During the removal of the cystoscope, it was felt that the catheter had not remained in the ureter. In the fluoroscopic room our suspicions were corroborated by finding the catheter in the bladder. For this type of patient, Dr. Hugh H. Young has made an improvement in a cystoscope which requires very little fluid distention of the bladder, and thus reflex irritability caused by the fluid medium in the bladder is reduced to a minimum.

The catheters used for pyeloscopic examination should, of course, be opaque and of sufficient size to be conveniently passed into the ureters. It should not be necessary to caution the operator that the catheters should be of excellent quality. The de-

Fig. 7. Films made at the same stage of respiration, with the patient in (*left*) erect and (*right*) prone positions. Kidney is shown to be movable.

Fig. 8. Photograph showing fluoroscopy on a cystoscopic table.

Fig. 9. Two opaque catheters in place, in a case of bilateral double ureters. Catheters are in a bad position.

fect most often observed is a break one-half inch from the catheter tip. Constant use of the elevator on the operating cystoscope, for purposes of guiding the catheter into the ureteral meatus, causes a scaling of the varnished surface of the catheter. Also, the eyes of the catheter are responsible for a certain amount of weakening in this area. Repeated sterilization eventually produces a roughened, very flexible tip. The catheters should be thoroughly examined by the cystoscopist before each procedure.

A defective catheter (Fig. 1), noted on fluoroscopy, was used in one instance with the result that it bent upon itself in the

ureter. The catheter was withdrawn until it straightened itself out before the injection was started.

The opaque solution, sodium iodide from 20 to 25 per cent, is used exclusively at Jefferson. For cystographic purposes, the strength of the sodium iodide need not be over 5 per cent. Lipiodol has never been used in our clinic for retrograde pyelography. Mainly because of the expense involved, the substances used for excretion urography are rarely used for retrograde work.

In regard to the method of injecting the fluid into the renal pelvis with a syringe, or using the gravity method of allowing the solution to run into the renal pelvis, we find the latter procedure more satisfactory. It is the exception rather than the rule to use the syringe method.

It is felt that simultaneous bilateral pyelograms are not to be recommended, although many urologists have the roentgenologist make bilateral pyelograms. It would seem that if pyeloscopy is employed as a preliminary to retrograde pyelographic work, little or no ill effects should be noted if both kidneys are injected at one sitting. However, we feel that it is safer to inject only one side at a time. We have not seen any complications following bilateral pyelograms when pyeloscopy was employed.

Fig. 10. Single catheter used to inject a case of bifid ureter, filling both kidney pelves.

After the opaque catheter is introduced into the ureter, the patient is brought to the pyelographic room of the x-ray department, where he is routinely fluoroscoped to determine the location of the tip of the catheter. We feel that the most advantageous site for the catheter tip is at the level

of the iliac crest, or lower. If the catheter is at a higher level (Fig. 2), or if the catheter is angulated (Fig. 1), it is withdrawn and replaced in a satisfactory situation.

The burette is connected with the catheter, and the injection is done by elevating the burette and letting the sodium iodide solution flow in by gravity. The injection can be stopped at any point by pinching the rubber tube or by lowering the burette. Fluoroscopic control is exercised throughout the entire injection (Fig. 3). By pyeloscopy, we watch the filling of the kidney and, thereby, prevent over-distention. Frequently, the kidney pelvis is so irritable and the filling so difficult that it is impossible to make a satisfactory Potter-Bucky diaphragm film. In these cases we make a quick exposure (Fig. 4), using the fluoroscopic tube with the film on the anterior aspect of the abdomen. We use a small diaphragm opening to avoid scattered radiation.

Roentgenograms revealing the kidney well filled at the time of the fluoroscopic examination compared with the same kidney filmed on the Potter-Bucky diaphragm are shown in Figure 5. The latter film was made immediately after the former, but due to contraction the kidney is not so well filled at this time.

Under fluoroscopy, palpation of the abdomen in reference to the urinary tract becomes an exact science. Definite localization of points of tenderness or of fixation are established. We can determine whether tumor masses in the abdomen are a part of, or attached to, the kidney. By pyeloscopy, the effect of respiration on the position of the kidneys can be seen. The patient is fluoroscoped both in the upright (Fig. 6) and in the prone postures (Fig. 3), and films are made if indicated (Fig. 7). The film made with the patient in the erect position shows the kidney to be below the level of the iliac crests. In the recumbent position, it is at a much higher level.

We always make a 14 × 17 Potter-Bucky diaphragm film with the patient in a recumbent position, and, recently, we have been making a similar film with the patient lying on the side of the catheterized ureter.

Those patients whose ureters are difficult to catheterize, or in whom transportation is difficult or contra-indicated, are cystoscoped in the pyelographic room. Our cystoscopic table is equipped with a tube under it, so that we are able again to exercise fluoroscopic control for the injection (Fig. 8). The procedure is essentially the same as in the examination of the patient who has been catheterized before coming to the x-ray room, except that we do not examine him in an upright position or make lateral films of the abdomen after injection.

Occasionally, we are faced with unusual conditions which require variations in our routine. The study of some ureteral anomalies needs special technic. When we are examining a case of double ureter (Fig. 9), we catheterize both of them. In such a recent case, while doing the routine fluoroscopic examination before injection, it was noted that the catheters were at too high a level. They were both withdrawn before the sodium iodide was introduced.

The bifid ureter presents a different problem; the catheter must be withdrawn to a point just below the bifidity before the injection is started (Fig. 10). Usually, a clue to the presence of a bifid ureter can be obtained by careful pyeloscopy at the time of injection. A small amount of the opaque solution can be seen entering both ureters at the point where the ureter separates into two parts. Then, by withdrawing the catheter to this level both parts of the ureter and both kidney pelves can be injected at one time.

After the injection has been completed and the necessary films made, the catheter is allowed to remain *in situ* if drainage of the kidney is difficult. In other instances, in which drainage is good and in which it has been seen that the solution regurgitates into the bladder alongside the catheter, the catheter is withdrawn. Fluoroscopy is frequently resorted to, in order to determine if the kidney empties properly.

Since 1912, when Dr. Manges first es-

tablished the desirability and necessity for pyeloscopy, we have followed this procedure routinely. We have not blindly injected a kidney at Jefferson in over twenty years. The advantages of precision and accuracy far outweigh the extra amount of time consumed in making a complete, satisfactory study.

SUMMARY

1. The routine procedure of retrograde pyelography employed at Jefferson Medical College is described in detail.

2. The method of studying patients fluoroscopically on the cystoscopic x-ray table is mentioned.

3. Technic used in examining cases in which anomalous ureters are present is reported.

4. The necessity for pyeloscopy, in order to make a complete and accurate study, is emphasized.

A SEMI-AUTOMATIC IMPLANT-CUTTER

By WILHELM STENSTROM, PH.D., *and* CARL E. NURNBERGER, PH.D., *Minneapolis*

Section of Biophysics and Cancer Institute, University of Minnesota

TECHNICIANS who collect and handle radium emanation are inevitably exposed to some radiation. The accumulation of the effect from such exposures may easily exceed the safe limit, with serious consequences. It is necessary, therefore, to take certain precautions, and it is, of course, best to reduce the exposure as much as possible. An automatic implant-cutter is one of the most helpful devices to reduce the time required to handle implants and to minimize the exposure.

Immediately after a piece of gold tubing has been filled with radon on the emanation plant, it sends out only a negligible amount of gamma rays. This radiation increases rapidly with time, to reach its maximum value after about five hours. After one hour the value exceeds 50 per cent of the maximum, and it is evident, therefore, that a person handling this tubing for more than a few minutes would be exposed to a fair amount of radiation. The whole tubing can be cut off from the emanation plant immediately after it has been filled. It then has to be cut up into a number of implants, and this process, which requires an appreciable time, used to be performed manually by means of a pair of ordinary diagonal nippers. As long as only a few implants have to be made each week, it is safe enough to use this method, but when the number of implants required exceeds 100 per week the danger of too much exposure during such manipulation becomes appreciable. It then becomes advisable to eliminate this exposure by the use of an automatic or semi-automatic implant-cutter. We shall here describe a rather simple

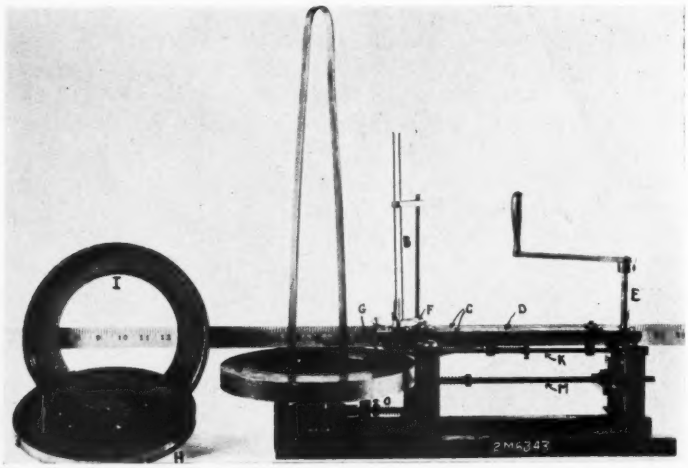

Fig. 1.—Machine used for semi-automatic cutting of gold implants. *A*, steel base; *B*, glass tube through which gold feeds into the cutter; *C*, fixed bars which hold the stationary blade; *D*, bar which holds the movable blade; *E*, crank shaft with cams; *F*, coil spring to release gold tube from the stationary blade; *G*, funnel to guide implants to the container below; *H*, implant container; *I*, lead protection screen; *J*, lead screen, and implant container with long handle attached; *K*, shaft to operate the wire brush and bronze spring "stop" below the blades; *L*, part of the steel frame of the cutter; *M*, shaft to rotate the implant container; *O*, break arrangement to regulate the rotation of the container through small angles.

apparatus which was built at the University of Minnesota and which has proved to be very useful during the last two years.

tions supplied with half a gram or less of radium in solution.

The two chief features embodied in the

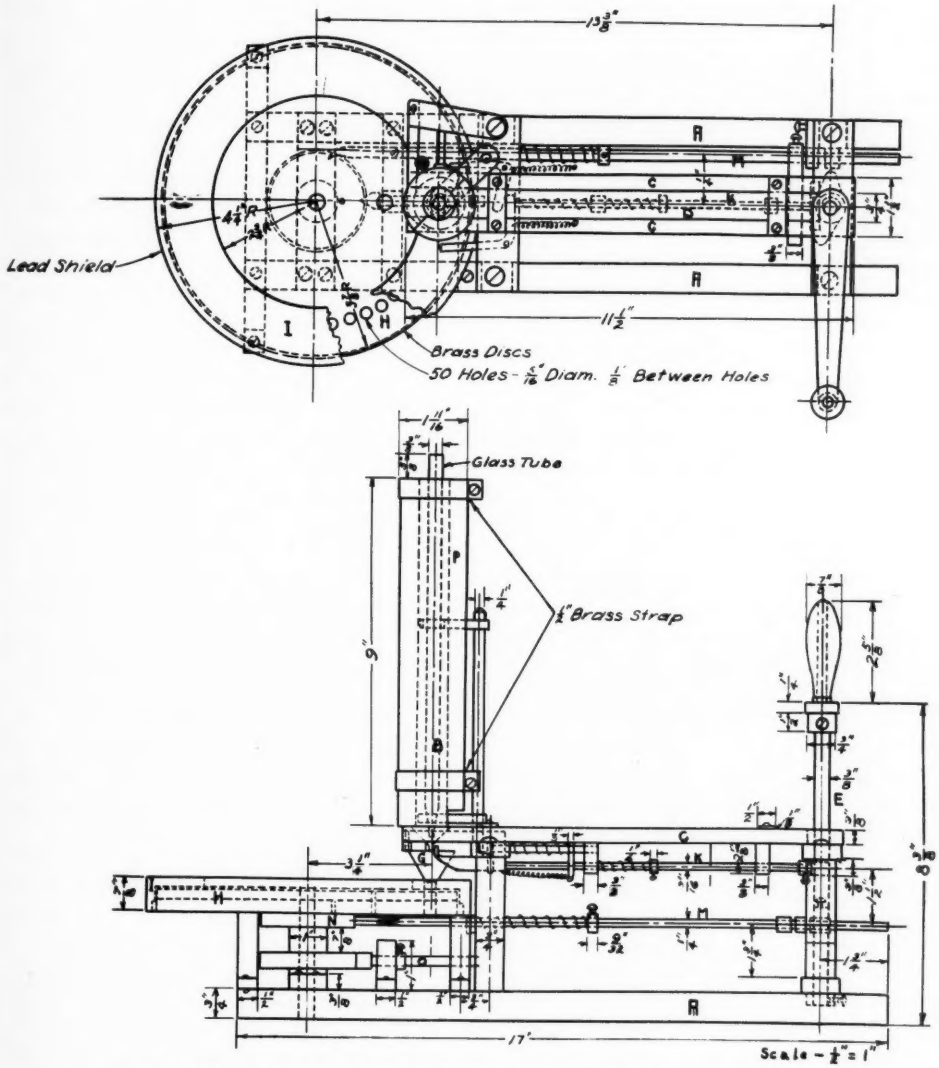

Fig. 2.—Side and top view of the implant-cutter (see Figure 1 for explanation).

The principle applied is self-evident and has previously been utilized by G. Failla at the Memorial Hospital, New York City, for construction of a larger and more elaborate implant-cutter. However, the one described here can be built at a rather small cost, which is important at institu-

semi-automatic implant-cutter are ease and speed of manipulation, and adequate protection to the person preparing the implants. The cutter delivers implants of any desired length between 2.5 and 6.0 mm., and deposits each one in a separate pocket of the container in order that the

radon content may easily be measured individually.

The cutter is shown in Figure 1, and details of its construction are given in the mechanical drawing in Figure 2. A horizontal stand, *A* (Figs. 1 and 2), made from steel bars, constitutes the base. About four inches above the base and near the center of the cutter are the blades. They are directly below the vertical glass tube, *B*. One blade is held across the ends of two horizontal bars, *C*, which are a part of the frame. This blade is stationary. The other blade is attached to one end of a third bar, *D*, which is made to slide freely between the other two. Each blade is solidly attached to its support by screws, which may be seen in Figure 1, directly below the bottom support of the glass tube. The other end of the middle bar is held firmly against a cam on the vertical shaft, *E*. The blades are opened and closed when the cam is rotated by means of the handle at the top of the shaft.

The blades are made of hardened tool steel; their top sides only are beveled. The edges are curved slightly so that contact is made at a point near their centers where the gold is cut. The condition of the edges is important: if they are sharp the gold tube is not pressed together and the radon leaks away. On the other hand, if they are too blunt, then wedge-shaped ends on the implants are produced. Properly conditioned edges may be found by the "trial and error" method. Demountable blades are preferable to permanent ones because used blades can be replaced or removed for repair without difficulty.

The gold tube taken from the radium emanation plant feeds into the cutter by its own weight through the glass tube, *B*. When the blades are separated, the gold tube falls between them to a "stop" situated a short distance below, consisting of a small flat piece of bronze which can be set at various distances from the blades, to be determined by the length of the implants. The bottom one-half inch of the glass is made of capillary tubing in order to prevent the short piece of gold tube, which is left when nearly all of the implants have been cut, from slipping sidewise in the glass and falling beyond the "stop." The inside diameter of the capillary is just large enough to permit a straight gold tube to fall through freely. In this manner all of the gold is cut by the cutter into lengths suitable for use.

The implants being made of 24 karat gold are, therefore, quite soft, and consequently, they and the uncut tube stick to the blades. The latter always sticks to the stationary blade and will not drop to the "stop" if allowed to remain so when the blades separate; therefore, a spring, *F*, has been added which moves the bottom end of the glass to a position midway between the open blades, thus releasing the uncut tube. The implants when stuck to either blade are swept away before the blades open by the sidewise thrust of a piano wire brush. The funnel, *G*, directly below the blades, guides the implants to pockets in a container below. The funnel can be turned to one side to permit the removal of the container from the cutter.

The implant container, *H*, and a one-quarter inch lead protection screen, *I*, are shown in Figure 1 (removed from the cutter). At *J* they are in place and the container is ready to be filled. A 14-inch handle is also attached. The container is made of brass and is cylindrical in shape. It consists of two parallel plates, each about one-quarter inch thick. In the top plate are fifty holes, located on the circumference of a circle near the edge of the plate. The bottom plate has one hole similarly located. The plates are held together coaxially, with their flat surfaces in contact, so that the two together form a container with 49 one-quarter inch pockets. The plates are rotated together about a vertical axis through their centers when being filled with implants: they can, however, be rotated separately. When the top plate turns with respect to the bottom one, the implants are one by one brought over the single hole in the bottom plate and dropped through. The separate rotation of the plates is used with the implant

measuring equipment and will be described in detail elsewhere.

The lead shield, *I*, covers the pockets and the outside edge of the container. The shield rests on top of the plates when they are being carried about, but when the container is on the cutter to receive implants, the lead is held stationary by three short posts which support the lead slightly above the plates. There is a small hole in the lead directly below the funnel and over a pocket of the container.

The rotation of the shaft, *E*, operates all of the movable parts of the cutter by means of three cams. The function of the top cam has already been described: the second cam moves a small rod, *K*, parallel to the base of the instrument. This motion of the rod in conjunction with a lever arrangement under the bar, *L*, causes the piano wire brush to move sidewise directly beneath the blades. It also withdraws the "stop" from under the blades when the implants are swept away. This prevents free implants from lodging on top of the "stop." The bottom cam operates the shaft, *M*. A trigger on the end of *M* catches in the teeth of the sprocket wheel (*N*, Fig. 2) just below the implant container. The forward displacement of *M* rotates the container through a small angle, just sufficient to bring the next empty pocket under the funnel. Below the sprocket wheel, but on the same axis, is a disc with fifty notches cut in its circumference. A wedge-shaped pin, *O*, fits into these notches and is held there by a spring. The disc with the pin serves as a break to prevent the implant container from rotating after the crank has stopped.

The top cam is soldered to the crank shaft, while the other two are held by set screws. The relative positions of the cams are important because each step in the act of cutting an implant must be properly timed. One revolution of the crank cuts one implant, deposits it in a pocket, and brings an empty pocket under the funnel for the next implant.

A considerable part of the protection to the technician, particularly from the gamma rays of Radium C, results from the speed of cutting the gold tubes. The whole process of taking a gold tube from the radium emanation plant and cutting it into fifty implants is completed in less than two minutes. Not very much Radium C would be formed in this short life of the radon, and, therefore, the gamma-ray activity would be small. The distance between the technician and the active tubes contributes to the protection. The nearest part of the body to the active tubes is the hand—this minimum distance is about ten inches. Finally, lead shields are used where needed. The lead screen around the implant container has already been described. Another lead screen, *P*, in the form of a tube surrounding the glass, is shown in Figure 2, but was removed from the cutter when the photograph (Fig. 1) was taken.

The machine is sturdy but not bulky in construction. All of its parts, particularly the tool steel blades, should withstand unlimited usage. No special amount of skill is required to operate it successfully, since merely turning a crank takes care of every step in the process of cutting implants. The handling of gold tubing and implants with forceps is almost entirely eliminated so that loss by accidental dropping does not occur.

The technic of radon therapy with gold implants has developed in recent years to the extent that it is often desirable to have implants of various strengths available for implantation. Our implant-cutter meets this demand, since the strength of each individual implant can be determined by its length. We generally cut our implants into two or three lengths. Typical groups were measured as follows: sixty-one implants of two lengths—of the shorter implants, seven contained 1.4 mc. each, twenty-one contained 1.5 mc. each, three contained 1.6 mc. each; of the longer implants, seventeen contained 1.9 mc. each, and three contained 2.0 mc. each. Seventy-five implants of three lengths had the following strength: forty-three, 1.5 mc. each; seventeen, 1.6 mc. each; five,

1.8 mc. each; three, 1.9 mc. each; four, 2.7 mc. each, and three, 2.6 mc. each. All of these implants in each group were cut from one end of the gold tube. The measurements show, however, that this is not a serious weakness in the method, for the various groups of gold implants of equal lengths are fairly uniform in their radon content.

To insure perfect sealing of all implants, we have found that occasional readjustment of the blades is necessary. This is most probably due to wearing away of the surface of the brass cam near the top of the crank shaft. The blades, therefore, are not closed tightly. Replacement of the brass cam by one made of hardened steel will undoubtedly eliminate adjustment of the blades.

This apparatus has been used two years and has, during this time, been very satisfactory and helpful.

SOME REMARKS REGARDING THE MEDICAL EXPERT WITNESS AND THE PERSONAL INJURY SUIT SITUATION[1]

By I. S. TROSTLER, M.D., F.A.C.R., F.A.C.P., *Chicago*

RECENTLY, a friend asked me several questions regarding medico-legal matters, and believing that my replies may be of some slight interest to others, I will give them to you; not as an authoritative treatise, but merely as an argument for the betterment of the conditions mentioned.

The questions asked me may be readily inferred from the trend of the answers. I quote some of these questions in part.

I do not "consider that medico-legal testimony, in the average to-day, tends to a fair adjustment of the issues at stake." I say this because, if a shrewd, unscrupulous attorney employs an equally unscrupulous corps of medical expert witnesses, to swear to what he wants them to, practically every case in court and every suit tried, can be swung his way.

From my own personal observation, I have found that it is decidedly unusual for any corporation or other supposedly wealthy defendant, to secure honest justice in cases in which personal injury is claimed or alleged by the plaintiff. I have repeatedly seen judgments for large sums of money awarded plaintiffs in suits against large corporations, for alleged injuries which never occurred to the extent claimed (and testified to by expert witnesses), or *never occurred at all*, and I am sure that every physician in any large city knows of similar occurrences.

"*Some of the evils observed?*" . . . "*Pertaining to the Doctor's testifying.*" The attorneys, particularly those who handle personal injury cases, very frequently employ a group of so-called expert witnesses, who make a business of appearing on the witness stand in this kind of litigation. Some of these are willing to, *and do*, qualify as experts in practically every medical specialty. It is a fact that in one instance of my own observation, a man appeared, qualified and testified as an expert psychiatrist in one court, as a surgeon in another, as an expert in roentgen diagnosis in another, and as an expert in pediatrics in a fourth court, *all during one afternoon, and on the same floor in the Cook County Court House.* I do know it for the truth, but I was very creditably informed that this same man, a licensed physician, qualified and testified as an expert in pathology the next morning. Of course, this man—and far too many others—will testify exactly as whoever employs him desires, and as the lawyer in the case wants it done.

Another evil, which we as roentgenologists are subjected to and have to complain about, is the calling or subpœnaing of physicians as ordinary witnesses, and, after their appearance upon the witness stand, qualifying them as experts and requiring them to give expert testimony, even to the point of requiring answers to hypothetical questions. Roentgenologists subpœnaed to identify roentgenograms made by them or for them are frequently subjected to this vexatious imposition, and are paid only the statutory witness fee.[2]

"*Pertaining to the attorney's handling of the cases?*" Personally, I have very little to complain of in this regard, but I know of others who have plenty to complain about. When I am on the witness stand, if the attorneys know me or have had much experience in trying to ruffle or confuse me, they usually do not try that sort of thing a second time. But others, who have not had much previous experience with me as a witness, soon learn that their bulldozing and attempted browbeating do not get very far.

Medical expert witnesses are usually subjected to two diametrically opposing at-

[1] Presented before the Chicago Roentgen Society, April 11, 1935.

[2] If any physician-reader hereof has ever been the victim of this, and wants to know how to circumvent it, and will send me a stamped addressed envelope, I will give him instructions as to how to evade this iniquitous situation.

tempts to distort their testimony. First, the attorney for one side of the case endeavors to secure an over-statement or exaggeration of the medical opinion, in favor of his client; and immediately thereafter the opposing attorney uses every possible effort to minimize, discredit, and reduce the weight or force of the expert's testimony. Instead of trying in every way to secure the exact truth from the testimony of an unbiased witness, they treat that testimony much as opposing football teams treat the football—kicking, throwing, and carrying it back and forth from one end of the field to the other, instead of trying by every possible means to induce it to reach the smooth putting green and, from that, to the cup (of truth), as do our golfing friends.

Be that as it may, I must say that I can not blame attorneys very much for trying to confuse witnesses, because some of the witnesses I have heard testify, invite that sort of treatment by their manner and the wording of their replies to simple questions, or by their apparent fear to state that they do not know the correct reply to other questions, *when they do not know*. These witnesses should remember that no one man, be he lawyer, chemist, or physician, can possibly know all there is to his profession.

It has almost invariably been my experience that the less merit a case has, the more do the attorneys for that side try to befuddle the witnesses, particularly the expert witnesses for the defense. I have repeatedly observed that when an attorney realizes he has a weak case, he will *as a rule*, with numerous exceptions, of course, resort to browbeating and bulldozing of witnesses. Many attorneys will take cases with doubtful or little merit and try to build up, or cause doubt in the minds of the jury as to exactly what was the expert witness' meaning. They make an effort to throw up a cloud of tautological dust out of which they manage by more or less devious and rambling ways to lead the unwary witness into expressing himself in slightly different language, and then deliberately misinterpret this reply in slightly different phraseology to be a contradiction of the previous statements of the witness. By this process the attorneys try to, and in not a few instances do, mislead the jurors who as a rule have an i.q. of eight-year-old children, into believing that the witness has contradicted himself.

Practically all personal injury cases are taken by attorneys on a contingency or percentage basis, and not a few medical expert witnesses are employed under similar payment understanding. Consequently, both attorneys and witnesses of this ilk will stoop to any ruse, artifice, trick, strategy, contrivance, or wile to make it appear that the testimony against their cause is not true or has been contradicted; while at the same time, they introduce incorrect, untrue, prejudiced, and even perjured testimony, from and by professional witnesses, many of whom are so suave and glib-tongued, while testifying, that no amount of abuse or ragging can shake their equanimity.

"*Pertaining to the presiding judge's attitude and ruling?*" In regard to this, I am glad to say that in by far the greater majority of instances observed by me, the attitude of the judges and their rulings were in accordance with sense and justice. However, I have repeatedly observed (and of this there is no question in my mind) that they see and interpret medical facts and conditions through a lawyer's point of view only, as must naturally be expected. I mean that they look at these things from the legal aspect only, and do not see them as we of the medical profession must and usually do—from the human behavior, humane, and sympathetic aspect of affairs as presented to us from our study and knowledge of the conditions as they really are and as we have found them to be. We see many of these things with differently trained eyes, as though through lenses or different colored glasses, which filter out some of the artificial or extraneous things. We cannot expect untrained eyes to see these things as we do. Incidentally, one of the few rare exceptions to the foregoing rule was the late William Howard Taft, who, when he was a trial judge, many years ago

in Ohio allowed the human and humane side of his nature to come to the fore, and who was by all odds the best friend of the medical profession who ever sat upon any State or United States Supreme Court bench.

As to "*Suggestions to Correct some of these evils?*" I believe that the selection of expert witnesses and the admission of expert testimony should be more in the hands of the courts. Presiding judges should choose the expert witnesses from a list approved by the local or state medical societies for such service. If such a method were followed, it will be readily seen that much less biased, corrupted, prejudiced and/or perjured medical testimony would be introduced and given: honesty and justice would be furthered and everything would be better, except the few hangers-on who derive their living from their nefarious trade.

Along this line, and perhaps more pertaining to the "*Judge's attitude and rulings,*" it is my opinion that trial judges could and should exercise their authority more often than they do to exclude professional witnesses from testifying. They surely and certainly must know these professionals as well as any one can, and yet they allow them to appear repeatedly, and apparently close their eyes to the fact that these professional witnesses come into court daily, testifying for the same crooked lawyers at so much an appearance. I believe that the judges should require a greater and higher degree of competence, before allowing this or that group of professional witnesses to qualify as experts.

Also, presiding judges, in their summing up of the testimony and in their instructions to the jury, could at proper times and should in many instances, call attention to the fact that the testimony given by these professional witnesses should be taken with a grain of salt. This has been done in quite a number of instances, over the exceptions and objections of attorneys; but the actions of trial judges so instructing juries have been upheld by courts of last resort nearly every time that such instruction was made a part of the cause for appeal. I am sure that all of us agree with Lloyd Paul Stryker, an eminent New York attorney, when he says,[3] "If judges when they have before them a paid incompetent posing as an expert, were when they charge the juries, to analyze his alleged qualifications as well as his mercenary motives in giving his so-called expert testimony, justice would be far more frequently done. The power and capacity of English judges in this field is not the least of the reasons for the high reputation of English courts."

A New York confrère who thinks much as the writer does, recently presented a paper before the Society of Medical Jurisprudence of that city, and in a recently published paper[4] stated:

> "It seems to me that when two people go to law, justice is on the side of only one. Therefore, the expert witness runs at least an even chance of selling his services to the side of justice.
>
> "An expert goes on the stand and is sworn to tell the truth, the whole truth, and nothing but the truth. However, I have repeatedly observed in court that attorneys in the very nature of their job under the present procedure, are no more interested in bringing out the truth as it helps their side, than they are in suppressing the truth as it is prejudicial to their side. It is possible, therefore, for the expert under present procedure to tell the truth and nothing but the truth, but in view of the opposing (or even his own) counsel to object, it is practically impossible to tell the whole truth. . . .
>
> "Therefore, when justice would demand judgment arrived at by calm deliberation on the part of experts who know what it is all about and who can weigh the pros and cons and finally come to a decision, the final opinion is left to twelve citizens who know nothing about medicine, and who could scarcely give a valid scientific opinion even if the only appeals made were to their reason. When on top of it all it is considered that lawyers on two sides have wooed the emotions of this jury with all the arts and wiles that are summed up under the term 'forensics,' when it is remembered that a wife with a nursing baby in court is worth more to a plaintiff than are two medical expert witnesses (which is my opinion based on my own observa-

[3] Courts and Doctors, Lloyd Paul Stryker, Macmillan, 1932, page 146.

[4] Suggestions for Improving Medico-legal Court Procedure, Ramsay Spillman, Am. Jour. Surg., October, 1934, **26,** 199–203.

tions, and you are at liberty to disagree with it if you like), so far as I am concerned, medico-legal procedure in court to-day is often nothing but burlesque; and while burlesque seems to have a place in the great social scheme, I hold that medical science has no place in burlesque.

"I might mention in passing that lawyers have made much of the inability of doctors to agree. It is my observation that disagreement between doctors is more common in court than it is in the hospital. I have been a part of many x-ray conferences where doctors would come into the case with divergent opinions; but as added evidence of one kind or another was introduced and the case was discussed dispassionately and scientifically and the added evidence was weighed pro and con, as a rule there would develop some degree of unanimity of opinion; this is as it should be, for as Dr. Courtney stated in 1915,[5] these opinions are derived from a series of facts and observations. But the court procedure of to-day could not be more unfavorable to a scientific study of a case by experts if it had been devised with malice aforethought.

"The legal profession has tyrannized over the medical profession with no mercy at all, on the matter of subpœnas. As a would-be law-abiding citizen, I should have the constitutional right to pursue my legitimate pursuits where and when I please. If I make an appointment to see a patient in my office on Wednesday morning, and the patient is postponing other business to see me at that time, I should have the right to feel confident that, barring the ordinary hazards of life in a big city, I can see that patient. But any lawyer, be he ornament of the bar or just plain bar-fly, can send a process-server into my office on Tuesday just before I leave for home, perhaps after my secretary has gone, and if I open the door myself I may find a subpœna in my hand commanding me to lay all other business aside and appear at such-and-such a court at 10 A.M. Wednesday; unless I go, I risk a term in jail for contempt of court. The case is more likely than not to be some fracture case of which I saw the films at the hospital three years ago, and, pro-rating my monthly honorarium at the hospital for that case, my original stipend for my services to that patient may have been some such figure as eighteen cents. I am assured that if I am put on the stand as an expert I will be paid as an expert. How do I know in advance whether I will find myself appearing as an expert the following day for a respectable crowd, or for a gang with whom I would not be found dead at a dog fight? The general appearance of the process-server is more often than not a promise that the latter will be the case. I deeply resent the indiscriminate and unintelligent use of the power of subpœna; I can assure the legal profession that a great many other doctors do also; and I advise the latter not to remain inarticulate on the subject if they do not like the present situation.

"The criticism of the legal profession by a distinguished physician nearly twenty centuries ago as recorded in Luke XI, 45 *et seq.*, finds a cordial echo of many a medical man of to-day. The situtation of which the present paper is a complaint is, therefore, not a new development."

I am sure that all who hear or read the foregoing quotation will agree with the writer that the statements made by Dr. Spillman are well expressed and to the point at issue.

Provision should be made, either by statute or otherwise, for just and adequate payment for such testimony as requires expert knowledge, which we as physicians have a right to expect to be paid for, because that knowledge is our own private property, that which cost us much effort, time, and money to acquire, and which is our stock-in-trade and is, in fact, the only thing we have to sell. As physicians, we should have the same kind of legislation and legal protection that the laws of our States provide for the legal profession. If we were anywhere nearly as active in politics and law-making as are our friends of the legal profession, we would have the same kind of protection.

In regard to "*Steps in the way of co-operative understanding between the medical and legal professions*," as hereinbefore stated, we have little that would be really constructive or of value to suggest, except that the attorneys make a little more searching investigation of the merits of the cases before deciding to accept them. However, *honest, upstanding attorneys do that*, and honest, honorable physicians have little or nothing to fear from that sort of attorneys, and want nothing to do with others. We want no pacts or agreements with the blacklegs and shysters and need none with the honorable and honest attorneys.

One of my pet peeves along medico-legal lines in regard to court procedures, is the

[5] Boston Med. and Surg. Jour., January 6, 1916.

laxity of nearly all courts in relation to the identification of roentgenograms and the requirement of proper qualification of the witness who interprets them—if the roentgenograms are not turned over to the lay jury for interpretation, which is not so rarely done. I have dozens of times, when on the witness stand, been handed roentgenograms to interpret, which bore absolutely no identifying marks as to who or what they represented; when, where; or by whom they were made. This, an absolutely preposterous situation, occurred to me three times during the past year (1934), so it is not only an old story but is being done—or perhaps I better say *not* being done—here and *now*. I went rather thoroughly into this subject in a paper in 1934.[6]

I am sure that you have been told nothing new in the foregoing; still I am vain enough to hope that some of you have been awakened to at least a better recognition of the situation, and perhaps even roused to a determination to try to improve our position, when we are called into court as witnesses.

25 East Washington St.

[6] The Legal Aspect of the Identification and Interpretation of Roentgenograms. I. S. Trostler. Am. Jour. Roentgenol. and Rad. Ther., November, 1934, **32**, 5, 680–693. Reprints furnished at 12 cents each.

THE IRRITABLE COLONSYNDROME[1]

By CLARK J. LAUS, M.D., *Syracuse, New York*

OUTLINE OF THE PAPER

1. Normal physiology of the gastro-intestinal tract (outlined).
2. Irritation:
   Neuromuscular apparatus;
   Lowering of threshold (predisposing factors);
   What can irritate; direct reflex.
3. The response to irritation:
   Hyperperistalsis;
   Mucus;
   Reflexes.
4. Symptoms produced and their mechanisms:
   Direct (pain, cramp, etc.); localization (referred pain);
   Reflex, vasomotor, etc.;
   Induced symptoms caused by the patient's therapy, etc.;
   Type of stool produced.
5. Diagnosis; interpretation of symptoms (physical, laboratory, x-ray).
6. Test-outs for colon distress.
7. Differential diagnosis.
8. Treatment.

OVER twenty years ago, B. W. Sippy introduced the term "irritable colon" as a descriptive clinical diagnosis. It was used particularly to avoid such inaccurate terms as "colitis," "intestinal indigestion," etc., in which hyperperistalsis of the colon was responsible for the clinical picture. It is to Sippy that I owe the background for much of what I have to say in the pages to follow.

What I have set down in this paper represents largely my own observations in Dr. Sippy's clinic, together with clinical experience in my own work over a period of nearly twenty years.

Colic has been known to physicians and laymen alike for centuries: that hyperperistalsis of the colon is responsible for symptoms other than colic has not been so universally understood. It should be better appreciated that the colon is responsible for more abdominal complaints than any other organ in the body. Clinicians have observed that hyperperistalsis in the stomach and the small bowel very rarely causes pain or much discomfort, even in the presence of a certain degree of organic obstruction. It is well known, for instance, that annular carcinoma of the small bowel may cause so little discomfort that the patient does not present himself until high grade obstruction is present and vomiting occurs. Many of these patients have noted that the wall of the abdomen at times had risen up in ridges for months previous. To explain these observations, several points in normal physiology may be brought out.

The gastro-intestinal tract under normal conditions carries on its motor activities as a unit phenomenon, each segment (esophagus, stomach, small bowel, and colon) contracting at its own rate under the stimulus of the intake of food.

The simplest way to sketch normal peristalsis is to trace a meal through the tract. The esophagus is merely a muscular chute propelling the bolus of food into the stomach in from one to four seconds, depending upon the type of food ingested. The stomach begins to contract as soon as material enters it, and actual emptying begins shortly thereafter. The rate and depth of gastric contractions vary within wide limits, as do the amounts of material that a given contraction may propel through the pylorus. However, under normal conditions, the stomach empties itself of an average meal in from three to four hours. As soon as any material enters the small bowel it is rather rapidly propelled onward. It should be remembered that the content of the small bowel is always liquid and that peristalsis is normally very active; thus, the small bowel empties itself of an average

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meal in from one to two hours after the last of the meal has left the stomach. It is in this relatively short time that the major portion of digestion and all food absorption takes place. The material entering the cecum is made up of water, excess secretions not absorbed by the small bowel, and finely divided undigestible residue of food. It is fluid or, at the most, mushy in consistency. In the colon, the time element in onward movement is radically different from that in the small bowel; the rate of movement in the colon averages only one-twenty-fifth of that in the small bowel. In other words, material entering the cecum takes from 24 to 80 hours to travel the length of the colon and pass out of the rectum. The wide range in time is due to the great variation in such factors as the make-up of the individual, diet, age, nervous influences, etc.

There are several types of contraction in the colon; those pushing the material onward (relatively weak peristalsis compared to the depth of the waves in the small bowel); undulating shuttle movements; haustral contractions, and the so-called peristaltic rush or mass movement. All of these movements are difficult to make out in clinical fluoroscopy except the peristaltic rush, which occasionally may be noted. Due to the fact that the material is still liquid in the cecum and transverse colon, and that it is being displaced by material entering the colon from the small bowel, the fecal stream is more rapid here than it is in the lower half of the colon. Material may normally reach the hepatic flexure six hours after the ingestion of the meal. As the absorption of water increases the consistency of the colon content, the rate of onward movement is definitely slowed. Thus material in the transverse bowel is mushy instead of watery; that in the splenic portion has a consistency of soft putty, and in the sigmoid the consistency is that of ordinary workable putty. Attention may be called to the difference in caliber of the right and left colon. As the residue is dehydrated it loses bulk and takes less space. From the lower sigmoid, small soft masses are pinched off and pushed along into the ampulla of the rectum. The ampulla, a physiological and not an anatomical "sack," may markedly vary its capacity by virtue of its great powers of distention. It holds an average of a pint of material with ordinary pressure, as observed in the barium enema. As the fecal mass in the ampulla and rectum increases in size, pressure against the walls increases. When a certain degree of pressure is reached, the physiological reflex—the "call to stool"—occurs. When the bowel moves, the ampulla and rectum are emptied to produce a soft formed stool about the size of a banana. The rest of the colon remains filled, this part of its content making up material which forms the stool of the next one or even two days.

The normal stimulus to contraction of the colon is a combination of the following three factors:

(1) Reflex—the gastro-colic reflex.—As soon as peristalsis is set up in the stomach by the ingestion of food, the colon becomes active.

(2) Pressure stimulation.—The contact of the bowel content with the wall of the bowel stimulates contraction.

(3) Chemical stimulation of the neuromuscular apparatus by the vegetable acids found largely in vegetables and fruits.

Just what and how much influence reflexes originating in the vegetative nervous system centers, the centers of the midbrain, and those arising from emotion, have when colon function is normal, is difficult to evaluate. In the instances of pathologic peristalsis, the significance is marked and thus more apparent.

In the light of experimental observations in animals and man, direct and fluoroscopic, it can be readily understood that control of the multiplicity of known factors influencing peristalsis is virtually impossible. Description, classification, and the establishment of any rigid norm are likewise not feasible. Thus, finely drawn distinctions and arbitrary findings in given sets of experiments must be interpreted or applied in clinical instances with great caution.

It should be emphasized that evidence of hyperperistalsis in the stomach and small bowel is not common in the absence of obstruction. However, when hyperperistalsis can be demonstrated by the x-ray or observation of the abdomen, as in duodenal ulcer or pernicious anemia, the patient rarely complains of pain. I have seen patients with ulcer pain and peristaltic waves raising up the abdominal wall, in whom, after the pain was relieved by alkali, the waves rolled on as before. It is, then, only in the colon that demonstrable and significant perversions of peristalsis and contraction are responsible for symptoms in the absence of organic disease.

Why should this be true? It is due largely to the fact that peristalsis in the stomach and small bowel is *normally* active and fairly rapid, the contents are fluid, and there is no retardation of onward movement by haustral contractions. In the colon, on the other hand, peristalsis is *normally* slow and relatively feeble; the contents are less fluid over at least two-thirds of its length, and the mechanism of haustral retardation is present. Exception might be taken as to the slow rate of movement when the so-called peristaltic rush is considered—a mass movement of a fairly large amount of material over a long distance of the colon in one sudden rush. I have seen it only on the right side of the colon. It has been assumed to be a normal phenomenon, because it is observed so frequently. I have not heard any individual describe the sensation, nor have I seen it under the fluoroscope in any patient whom I considered to have a normal colon function.

Hyperperistalsis, cramp, or spasm is caused by exaggerated response of the neuromuscular apparatus of the colon, due to the following: (1) hyperirritability to normal stimuli; (2) excessive stimulation (irritation) to a mechanism of normal irritability; (3) a combination of both the above. Usually a mixture of the two factors may be found. Worry, fatigue, and particularly emotional stress, lower the threshold of irritability, especially if these conditions are operative over a long period of time. The lay term "nervous tension" perhaps describes this state of affairs best. When on this condition are superimposed dietetic errors in the way of too irritating residue, catharsis, high colonic enemas, etc., a vicious circle of no mean proportions is set up.

The most common factor in the predisposition to a hypersensitive neuromuscular apparatus in the colon is that of "constitution" or make-up. A large proportion of the patients suffering from symptoms referable to irritable colon belong to what I prefer to call the "vegetative nervous system unstable"group, rather than the "allergic," etc. Along with colon disturbances, they have the predisposition to, or evidences of, such etiologically related conditions as migraine, urticaria, Quincke's edema, eczema, hay fever, asthma, hyperthyroidism, Raynaud's disease, etc., along with the myriads of vasomotor disturbances so commonly seen. In these patients, irritable colon is merely one manifestation of a hereditary make-up which is prone to perversions of vegetative nervous system physiology such as may occur in any system or organ in the body. Together with instability in the autonomic mechanism, manifestations of emotional instability are found. Exaggeration of response to emotional stimuli parallels that of the vegetative system itself. It is important to observe that the disorders of the nervous system noted above are matters of degree of response in terms of the normal, and in no way vary in the kind of response. Thus, patients of this group as a rule do not fall into the classification of true psychosis as it is to-day interpreted. It is easy to understand that emotional instability may act as a force lowering the threshold of irritability of the vegetative nervous system and, also, should some emotional conflict of sufficient import to the patient occur, as the direct "tripping off" mechanism as well.

Another factor in lowering threshold and increasing irritability lies in the increase in speed, strain, and artificialty of modern life.

Since there are all degrees of the make-up mentioned above, it would seem fair to postulate that many patients ill to-day would have adjusted themselves, automatically as well as consciously, in an environment with less strain. However, with the driving energy, loss of sleep, and emotional conflicts, so characteristic of life to-day, bombarding the human nervous system as they do, it is not strange that derangements in the operation of that mechanism occur. The material side of life can and does change with remarkable speed—human physiology only over the thousands of years. Thus is the capacity of the human organism to adjust itself to its environment and to other like organisms, so far outstripped in speed by that environment, that an increase in all disorders due to disturbed physiology may well be expected.

Any stimulus which can normally set up a response of the neuromuscular apparatus of the colon, directly or reflexly, may, when the threshold of irritability is sufficiently lowered, become an irritant. Thus, what causes trouble on one occasion, may not do so on the next. The etiologic possibilities in cases of irritable colon thus become legion. However, it is possible to group and somewhat classify most of the common sources of irritation:

I. Irritants acting directly upon the gastro-intestinal motor mechanism:
   (*A*) Diet—
      (1) Residue too coarse;
      (2) Vegetable acids too irritating;
      (3) Excessive quantity of residue or chemically stimulating substances which in normal quantity are not irritating;
      (4) Idiosyncrasies or allergic reactions to specific foods.
   (*B*) Cathartics—
      (1) Drugs;
      (2) Artificial roughage intake (bran, agar, psylla seeds, etc.);
      (3) Non-absorbable oils (mineral oils, etc.).
   (*C*) Enemas—
      (1) Medicated;
      (2) Large enemas, so-called colonic irrigations.
   (*D*) Bacterial exo-toxins.
   (*E*) Drugs and poisons (lead, arsenic, etc.).
   (*F*) Thermal effects (cold foods and drinks).

II. Reflex irritants:
   (*A*) Emotional reflexes.
   (*B*) Thermal effects (intensive chilling of the body surface).
   (*C*) Bacterial toxins acting through the central nervous system or blood.
   (*D*) Allergic reactions.
   (*E*) Organic disease of the rectum or abdominal viscera.
   (*F*) Coffee, tea, and alcohol.

I believe that fairly well balanced meals are the rule in America. Misinformation and ignorance, largely from advertising, are responsible for dietetic notions and fads which so frequently unbalance the diet. The idea that the colon produces and absorbs toxins has its root in folklore, medical as well as lay. It is continually played up by quacks and the sales pressure for patented foods, in spite of the facts easily available in standard physiologic texts. Trick reducing diets, vitamin foods, foods to supply minerals, offered with "scientific" plausibility that convinces not only most laymen but many physicians as well, flood the country. It should be remembered that the colon is not a true excretory organ in the sense that the kidney is, at all. Its function is merely to conserve water, salts, and probably other digestive substances by absorption, and eject the non-digestible material taken into the gastro-intestinal tract. Ignorance of true colon function, and the ascribing to the colon functions which it can not perform, explain much dietetic meddling.

The notion that a bowel is "sluggish" and, therefore, lacking in propulsive force, as is mirrored in the term "atonic constipation," induces physicians and laymen to attack the bowel with increasing quantities of irritating residue in the form of coarse vegetables, fruit, fruit juices, and artificial roughage. As a matter of fact, there is much doubt that, except in cord lesions and certain cases of arteriosclerosis, such a condition exists. I know I have never seen it.

Cathartics are effective because of their irritating properties. It is simply a matter of degree of irritation—running the gamut from croton oil to agar and mineral oil. They have in common the disadvantage of abuse, habit-formation, disturbance of rhythmicity, and the production of symptoms due to hyperperistalsis. Fortunately, digestion and absorption take place normally with such speed that only in the case of the continual use of drastics is there direct interference with nutrition.

Many people get into the cathartic habit on one or both of two bases. The patient taking the average cathartic is likely to empty the entire colon. Thus, even though he eats normally there is often no movement for from one to three days following. Worry over this, and discomfort caused by the cathartic, but which he ascribes to the fact that the bowel has not moved, force him to seek relief from another dose. The relief which comes when there is a movement convinces him that his course was proper. Here again misinterpretation leads him further into error. It is the "breaking" of spasm, to which the passing of gas or stool was merely an incident, that gave relief. This relief is permanent only when the circumstances setting up the irritable colon in the first place subside, and medication is stopped, neither of which occurs as a rule. Thus the vicious circle rolls on, one cathartic after another "wears out," which means that spasm is increasing in severity and duration under the lash of irritation, and a more powerful irritant is necessary to overcome it and get "relief."

In many instances, patients who never used cathartics became addicted to them because of their use post-operatively and in convalescence. I believe this to be a more common occurrence than is realized. The same situation may arise in any protracted illness in which the diet is temporarily unbalanced for any reason, and resort is had to cathartics.

With temporary relief of abdominal distress by a cathartic, vegetative nervous system reflexes causing symptoms elsewhere in the body, the vasomotor system particularly, often let up. Thus the symptoms so frequently termed "toxic"—headache, dizziness, pallor, lassitude, scotoma, etc.—are also "cured" by the forceful "breaking" of colon spasm, and the reflexes dependent upon it. These symptoms by virtue of their origin recur, and the necessity for "getting rid of toxins" becomes a steady job. This is the second factor in the train of events leading to the cathartic habit.

What has been said above applies with equal force to the misuse of enemas. Continued use of enemas with soda, soap, milk, and molasses, etc., and the colonic irrigation, are as harmful as cathartics. It makes no difference whether the irritant is ingested or run into the bowel, the result is the same. The quantities of mucus of which the irrigators are so proud are the result of the attempt of the colon wall to protect itself from irritation, in most cases caused by the enema itself. Mucus from any surface is the response of that surface to irritation of any kind.

I believe that bacteria and their end-products play a less important rôle in colon irritation than is usually thought. Organisms normally present, especially when colon physiology has been previously disturbed, may produce end-products in sufficient quantity to upset the bowel further. The gas-formers of the intestinal flora group, in the presence of carbohydrates and an acid medium, set up a so-called "fermentative colitis." A putrefactive process may produce similar irritating split products in protein in an alkaline medium. These substances cause symptoms by local irritation, as do cathartics. I know of no trustworthy evidence of absorption in sufficient quantity to produce an intoxication.

Little need be said concerning local irritation by drugs not used for their cathartic effect. Arsenic is an example of this group.

In susceptible patients, the effect of cold foods and drinks is an important factor in setting up hyperperistalsis. This effect is operative through the gastrocolic reflex.

Indirect or reflex over-stimulation of the colon is seen most commonly in those patients belonging to the vegetative nervous system unstable group. The most common of these are the reflexes set up by emotion. It is common knowledge that fear, for example, often causes spasm and diarrhea. In emotional maladjustments, particularly those with a sexual angle, a state of almost tonic hyperactivity may be present. Some instances of irritable colon are entirely the manifestations of psychiatric situations. More often, however, especially if the condition is of any standing, one or more of the other factors enters into the picture.

Thermal effects arising from chilling of the body surfaces may have an important bearing in the causation of spasm. Swimming in cold water, or the cooling influence of rapid evaporation when lying on the beach are common sources of this effect. Improper clothing in the cold seasons of the year make chilling a possibility in setting up cramp. Heat, of itself, as is well known, quiets hyperactivity as a rule.

Circulating toxic substances, bacterial or allergic, may, through the brain centers and probably also by acting directly on the peripheral ganglia, "sensitize" and irritate the neuromuscular apparatus. Absorption from focal infection seems, in some cases, to be a definite contributing factor. Colon symptoms, accompanying acute infections with fever, fall into this group. Many times, however, the diarrhea and cramps associated with the onset of acute infections are due to cathartics administered before the patient is seen. "Allergic" cases represent the reaction of the vegetative nervous system to a specific protein with localization, at least partially, of the response in the colon.

Reflexes from inflamed viscera—gall bladder, appendix, and tubes—may be responsible for motor disturbances in the colon. However, it is much more common to find that the irritable colon is due to the therapy for the original condition rather than brought on by the visceral disease. This is especially true in long-standing disease. Rectal conditions—fistula, fissure, infected hemorrhoids, crypt infection, and ulcer—are frequently overlooked as causes of abdominal symptoms on the basis of colon spasm. Unless the inflammation is acute, there may be little or no complaint of local pain. In many instances, the discomfort or pain in the abdomen is localized over the cecum. Rectal treatment has cured many of these cases after appendectomy had failed to afford relief.

The colon has the capacity to dilate, contract, and propel its contents forward by peristalsis. Its lining is absorptive, and secretes mucus which is a lubricant in the left half of the bowel. (A thin film of mucus may be detected on the surface of normal stools.) When irritated, an organ can react only within the scope of its physiology. The response of the colon in irritation, therefore, is an exaggeration in varying degree of its motor mechanism. Thus under irritation we might expect the following:

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(3) Excessive secretion of mucus—a protective mechanism.

In practice, one often sees patients in whom all three phenomena are present.

It is significant that in many diarrheas, with the patient definitely aware of the over-activity of his bowel, there is no complaint of distress or pain. This observation links with that of the lack of pain in the presence of obvious hyperperistalsis in the stomach amd small bowel. It would seem reasonable that if peristaltic overactivity does not set up pain in the upper tract, it would not in the lower. However, with the normally low grade peristalsis in the colon, the *degree* of hypercontraction might make it possible for

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sufficient cramping of the peristaltic mechanism to cause pain. Then, there is no mechanism comparable to the haustral contractions in the upper tract. Fluoroscopic observations and palpation during pain first led me to suspect that most colon symptoms, from colic to mild discomfort, are due to tonic spasm of this mechanism. I have observed the marked deepening of haustral markings seen in patients who happened to be having pain at the moment of fluoroscopy. On the other hand, I can not recall noting any contraction under the same conditions that I thought might be peristaltic in type. I am aware of the difficulty of interpreting what can be seen fluoroscopically, yet in thin subjects, with marked motor disturbance at the time of observation, I feel that fairly reasonable observation can be made and interpreted.

The element of pressure, and the influence of distention and stretching, are difficult to evaluate as factors in the production of pain, because they are so frequently associated with spasm. Then too, many instances of rather marked distention and stretching of a viscus occur in which, in the absence of evidences of contractions at the same time, pain is not complained of, although the patient may be aware of distention. While it must be admitted that stretching and distention may be factors in the production of symptoms in an irritable colon, my observations force me to feel that such influence is not a great factor in causation in many cases.

Patients often complain of distention and bloating—flatulence—or of a markedly distended rectum, when examination proves them to be in error. The association of flatulence with spasm and discomfort, and the fact that the patient can more easily identify flatulence and fails to recognize the cramp element, leads him to blame the wrong thing for his discomfort. The fact that he often gets relief with the passing of gas, causes him to associate gas and pain in a causal relationship. However, before gas can escape, spasm must let up, which is the real reason for the disappearance of the discomfort. The next time the patient is in distress, even though flatulence be not present, he blames "gas" for the distress because he recognizes the same sensation that was present when he did have distention and got relief when flatus was expelled. The association of aërophagia with an irritable colon serves to further compound the error.

What symptoms are produced by these disturbances? It might be well here to note that the complaints in this condition may be so mild as to be merely slightly annoying, or they may be so severe as to simulate the story of acute intestinal obstruction, acute appendicitis, or gall-bladder disease. The patient usually states his complaint in the form of meaningless terms supposed to be diagnostically helpful, such as "stomach trouble," "gas," "gastritis," "dyspepsia," "acid stomach," "biliousness," "nervous indigestion," etc. "Heaviness in the ovary" or "pain in the heart" are terms used because of localization of pain in the region in which the patient thinks the organs lie. A more objective description of what is actually felt is confused by the patient's inability to describe or interpret what happens. The very vagueness, variability, and moving about of the symptoms are suggestive of a colon disturbance. This is understandable in the light of the lack of specific sensory mechanism, the inaccuracy of localization, and the phenomenon of referred pain. The common association of vasomotor symptoms with irritable colon disturbances adds to the confusion. Thus the patient is forced to translate the abdominal sensation into an idea which can be expressed in terms common to him and the physician. I know of no condition in which the same story varies so much in the telling, depending upon the social state, experience, mentality, and emotional state of the patient. His threshold to pain and the wide range in severity add to the kaleidoscopic picture of the condition.

Some of the common terms used by pa-

tients are listed below. These symptoms may be classified according to their mechanism of production into four groups.

(1) Symptoms due directly to the spasm element:

Heaviness, weight, and pressure across the upper abdomen;

Tightness, fullness;

Rumbling and gurgling—gas moving about in the abdomen;

Ache, colic or cramp, pain (severe) coming in waves, "knotting" in type;

Tenesmus, constant desire for a movement;

Sensation of heat or burning across the abdomen.

The symptoms and their behavior vary a great deal, as might be expected in view of the multiplicity of possibilities and circumstance, yet there are certain earmarks that may be brought out.

Time and Circumstances of Onset.—The patient often states that the distress may come on at any time, that it is spasmodic, and that it moves about in the abdomen. The relation to food-taking is not constant. Food may have little to do with the tripping mechanism, especially in cases with a neurogenic etiology. There are, however, two types of relationship to eating that are common: First, distress coming on immediately after eating, an example of the gastro-colic reflex mechanism. It is *à propos* here to call attention to the fact that, in the absence of organic disease of the stomach or its coverings, or the ingestion of a frank local poison, the stomach itself does not cause discomfort or pain on the ingestion of food. The second type of onset corresponds to the time at which the head of the meal reaches the cecum. In this instance, cramp is instituted by the direct irritation of the wall of the bowel.

It is when distress comes on at this time with some regularity, especially if the cramp is manifest as a burning sensation and is associated with regurgitation and "acid stomach," that confusion with the ulcer picture occurs. This type of burning differs from that in ulcer in several particulars. It comes on at times immediately after eating and is not constant when present, but comes and goes. It is diffuse or felt across the abdomen, moving about and relieved only temporarily by alkali, and then, usually only if the patient belches, it goes over into cramp at times, and is often relieved by flatus or a bowel movement.

Frequently the hand indicates the entire abdomen as the site of the pain. Often the patient indicates with fair definiteness the course of the bowel, stating that when the pain shifts, it goes from right to left and not in the reverse direction. Distress onset or subsidence is associated with rumbling and gurgling. Usually, if there is any increase in severity, the heaviness, burning, etc., may change to a pain that is colicky, the patient recognizing the association if not the unity of causation of the two sensations. As a rule, the patient sticks to one subjective description at a given level of hyperperistalsis. No matter what the sensation at lower levels, when severe spasm is present, it is usually described as colic, cramps, or the vulgar but expressive term, "bellyache." The sensation presented at lower levels of hyperperistalsis may remain for minutes or hours: some patients will say that it is always present. It is usually associated with wave-like paroxysms of increased severity that are more easily recognizable as due to the colon.

At any level there may be a sense of desire for stool. In less severe instances, I think that this is tied up to past experience when relief was had from the passing of flatus or stool, a mental phenomenon (association of ideas). In more marked examples, rectal tenesmus and sphincter spasm occur, producing the sensation of a full rectum, even though the entire lower bowel be empty. Obviously, rectal pathology enhances the likelihood of this mechanism becoming active.

Pain over localized areas of the colon, if definitely and constantly localized over a small area, should raise the suspicion of an organic etiology, yet there are many in-

stances in which no such lesion can be demonstrated, either at operation or autopsy. Note may be made of some of the fairly characteristic sites for localization of pain.

Left Lower Quadrant.—Here, spasm is perhaps the most common of all. It is usually seen in cases due to the abuse of cathartics. Also, it is here that the pain is most easily recognizable as colonic in origin because of the ease with which the sigmoid may be felt in spasm and the tenderness on palpation. The patient usually leaves no doubt of the site of his pain when the bowel is rolled by the hand.

Right Lower Quadrant.—Pain here is almost as common, and because of the presence of the appendix, if still present, is more important from the standpoint of diagnosis. Pain at this point is most likely to occur under three conditions:

(1) Severe and prolonged left-sided spasm, usually with "packing up" in the ampulla and rectum, the dyschesia or obstipation of the British writers;

(2) The presence of rectal pathology;

(3) Sigmoid irritation by inflamed adnexa, pressure, or invasion by endometriosis.

It is well known that in intestinal obstruction in the sigmoid, the pain is likely to be right-sided. The effort of the bowel musculature becomes greater the farther away from the lesion. In "spastic colitis," dyschesia, obstipation, and constipation, in which the mechanism of pain production is the same, *i.e.*, irritation and spasm, simulation of low grade obstruction occurs. As a matter of fact, a low grade intermittent obstruction is actually present because of the "packing up" and the spasm holding for long periods. Hence, the "expulsive effort contraction" manifests itself on the right side.

The influence of tissue alteration incident to old inflammatory processes, appendicitis, influenzal perityphlitis, tuberculosis, tubal infections, etc., as a factor in right-sided localization is problematical. It certainly does not occur in all such cases. I have noted, however, that the cecum is much more irritable, judged by its palpability and tenderness, and by x-ray observation, after right lower quadrant operations—usually, of course, appendectomy. This may be true whether marked pathology was found at operation, or not. It is difficult to judge whether the finding is due to residuals of the original pathology, the operation, or the fixation of the region in the mind of the patient.

While localization in the flexures occurs, it is not as commonly seen as it is in the lower quadrants of the abdomen. Theoretically, angulation and redundancy suggest themselves as causes. Actually, from observation of many cases with marked angulation and redundancy, such localization is rarely seen, which makes it difficult to accept this condition as a factor in any of them. Too, in many cases, with localization in the flexures, no particular "kinking" is seen.

Autopsy and surgical exploration of the abdomen in which many adhesions were found, have long since shown that unless definite interference with motility, sufficient to cause a definite degree of obstruction, occurs, there are no symptoms except in instances in which the bowel has been mismanaged. In many instances in which interference with motility could be demonstrated by x-ray or at operation, it has been possible to manage the bowel so that function was normal and the patient symptom-free. With these facts in mind, it is difficult to postulate configuration and non-obstructive adhesions as factors of pain.

Patients often describe the pain in the flexure region as an ache or a sensation of pulling rather than a cramp alone. This suggests traction on the hepatic or splenic ligaments of the colon due to over-activity of the bowel as the reason for localization. Radiation to the back in such cases also seems to bear out this possibility. Much of the distress in the left upper quadrant in irritable colon is caused by the pressure of gas in the fundus of the stomach.

Pain in the area of the transverse colon appears, and at times may be demonstrable by palpation and x-ray. However, most of

the upper abdominal pain, in my experience, has been referred pain. I have no explanation of cramp localizing in this sector of the bowel.

Clinical application of the phenomenon of the conditioned reflex in localization in the colon is a fascinating subject for observation and speculation. In functional heart conditions this factor can be fairly well demonstrated to those who understand the mechanism. I have seen instances in which fear mechanisms were responsible not only for the reflex hyperperistalsis but for its localization as well. For instance, a relative dies of visceral carcinoma; the patient experiences pain, set up by any excitant, cathartic, or what not. There is accidental localization of pain in the area in which the relative's fatal growth was—apprehension and fear, and the vicious circle has been set up.

2. Referred pain or distress in an irritable colon frequently masks its origin. Unless the physician is aware of the possibilities and suspects the colon, that source of referred pain may easily be missed. Perhaps the most frequent type is that felt in the epigastrium, the "ball" or "lump" in the pit of the stomach of which so many patients complain. The cramp giving rise to this reference may be in any portion of the bowel. The distress may be felt only in the epigastrium as fullness, pressure, weight, heaviness, etc. It may radiate well up into the chest on either or both sides. Frequently, when the sense of bloating and pressure is marked, and especially if it is accentuated by distention of the stomach by aërophagia, distress in the precordium and palpitation occur.

When the colon is extremely irritable and sore, and there is reference to the epigastrium and chest, the patient's breathing is shallow, and false dyspnea is produced. In this instance, as in those of inflamed gall bladder, the downward thrust of the diaphragm increases distress. The shallow respiration is an unconscious effort on the part of the patient to protect himself from pain. Pain in the lower lateral areas of the back, while not strictly referred in origin, might again be mentioned here. Pain referred down the inside of the thigh is usually due to concomitant pelvic pathology rather than to bowel cramp, but occurs frequently enough to warrant comment. The same may be said of low sacral pain, which is a reference of rectal origin. A silent and therefore unsuspected rectal ulcer may be the cause.

The absence of the Head zone phenomena in this condition should be mentioned because of its differential diagnostic significance.

3. Associated vegetative nervous system symptoms, while they do not occur in all instances of irritable colon, do occur in the vegetative nervous system unstable group with such frequency and at times with such severity that any consideration of these patients would be inadequate without a discussion of this phase of the subject. These symptoms are important, too, because of the traditional misinterpretation of their origin and significance. "Auto-intoxication," "toxemia," and "toxic absorption" came into medical literature much more because of the insistence of patients that they felt "poisoned," or "toxic," than because of supportive facts from clinical and experimental laboratories. Headache and pallor have been confused with liver dysfunction and jaundice. Without going into controversies concerning research in toxic proteins and the production of symptoms by them, suffice it to say that to date no trustworthy evidence of the presence of toxins in the blood stream of these patients has been brought forward. Much of the supposedly supportive findings have come from the injection of toxic proteins into the blood stream of experimental animals in quantities not seen in man under any circumstances. Many tests for intoxication have been devised. Indican, for instance, can be found in most urines, and the quantity can be increased by feeding high protein, but there is no parallel alteration in symptomatology noted. On the other hand, clinical observation, supported by experimental work, abounds to show that these symptoms are reflex in origin. Two

common examples will illustrate this: The occurrence of headache with the rectum packed with feces and instantaneous relief on emptying the bowel. Relief comes too rapidly to be explained on the basis of toxin elimination from the blood. Also, the sudden cessation of headache under the impact of sharp emotion. Finally, there is the therapeutic test. If patients can be so managed that their physiology and psychology approach normal, the symptoms disappear without any material alteration in the possibilities for toxin formation and absorption. In clean-cut cases, this is very significant evidence. For instance, in an uncomplicated "bran" irritable colon in a vegetative nervous system unstable patient, in whom "toxic" symptoms are a prominent feature, these symptoms disappear with the distress as the colon again functions normally. Still more convincing perhaps is the instance of a clean-cut emotional conflict etiology. If the psychiatric problem can be eradicated, the entire picture clears up, with nothing else in the patient's diet or management altered by any other therapy. It is conceivable that functional derangements might cause chemical dysfunction and permit the accumulation of toxins as a result, but if true, it seems to me that such toxins should be found without much difficulty in some cases at least. Thus, until convincing evidence to the contrary is adduced, the weight of known facts forces the conclusion that the phenomena under discussion are reflex and not "toxic" in the generally accepted use of that term.

Vegetative nervous system symptoms arise from the same irritant acting on both the colon and some other area of the vegetative apparatus, or they become operative as a reflex from the colon irritation. Such disturbances, of course, may be entirely independent of colon irritation, as they are, for instance, in a ragweed hay fever in an individual with a cathartic-irritable colon.

Common symptoms in this group, which in my experience are more intimately related in etiology with colon disturbances, will be discussed. Bizarre manifestations are occasionally seen.

Under the head of vasomotor reflexes we find giddiness, dizziness, headache, faintness, weakness, blurring of vision, scotoma, hemianopsia, paresthesia, and syncope. All of these may be transient, mild, or very severe. The headache is usually less focal than in migraine proper, and it is likely to be less severe and more transient. However, it may simulate or actually be migrainous, which is not strange because the mechanism is almost certainly the same for both—vaso-dilatation and vasospasm.

With giddiness there is often a sense of insecurity, inco-ordination, and transient periods of lack of concentrating ability or temporary asphasia. Weakness and a feeling of low blood pressure (which actually is a characteristic finding in uncomplicated vegetative nervous system instability) may be so marked that great fatigue is experienced on slight physical effort. Paresthesia, cold feet and hands, numbness, tingling, the "inner trembling" so characteristic in the hyperthyroid patient, are all common. With any of the manifestations noted above, pallor due to peripheral vasoconstriction (the usual basis of the sluggish liver idea) may be noted. Mottling of the palms is noted. Cold sweats may be evidenced in severe cases. Syncope, often at the height of severe pain, occurs. Fainting while at stool is not rare. Palpitation and tachycardia are common reflexes, especially when the element of fear enters in. Spasm of the diaphragm and of the esophagus (globus hystericus) are seen.

One of the most common complaints is nausea, usually under some term such as "squeamishness," or a sense of over-satiation after a mouthful of food. Frank nausea is likewise common: it may be the only symptom. Under these circumstances, negative findings, suggesting any other cause of colon dysfunction and a positive finding, capped by the therapeutic test, reveal the origin.

The mental picture of the chronic dyspeptic of literature and experience is proverbial. No one is cheerful and smiling

with chronic abdominal discomfort, and this is particularly true of the patient with colon cramp. Some of the sourest and most harried faces I have ever looked into, belong to this class. With no other cause, the condition makes otherwise happy people irritable, sensitive, and low spirited. Actual depression of the single-day migraine equivalent type is common. It may be so severe that the patient fears for his mental state and is loath to admit the symptom. In instances in which there is an emotional factor, a most vicious circle is kept going. Often disentangling cause and effect is difficult, even after the patient has recovered.

Emotion, a function of the higher centers, must be considered a physiologic process. Hence, since vegetative nervous system control over the function, circulation, etc., of the cerebrum is admitted in principle, it is not strange that reflex disturbances in the higher centers could easily be responsible for emotional states seen in this type of patient. This could well be considered a purposeless, illogical functioning of a center reacting to a reflex with the only response of which it is capable. Thus, many patients term these emotional disturbances "phoney" because no recognized, legitimate cause for them is at hand.

It is recognized that these so-called neurotic symptoms arise from many causes other than irritable colon. They are often enough seen independent of bowel disturbance. However, it is well to remember that they may serve as cause, effect, or both, in irritable colon. They are discussed here because unless relationships and mechanism are recognized, diagnosis and therapy alike are imperiled. It is a grievous error to diagnose and treat neurosis and neglect the diagnosis and management of the bowel condition, and *vice versa*. It certainly is indefensible to label the patient a neurotic, implying or stating that he imagines symptoms and could voluntarily control them if he would. Except in the major psychoses, I have seen no patient who imagined symptoms, although there have been plenty of instances when the explanation of them was beyond me.

4. A fourth group of symptoms present in most cases includes disturbances induced by the patient himself in an effort to get relief from his discomfort. The longer the patient goes on, the greater and more varied the things he is told about and tries. Many of the "doses" do give some temporary relief, but cause more trouble later. The one most frequently noted is belching—it is well known that most patients attempt to "bring up" any type of abdominal pain. This is especially true when the sensation is one of fullness, pressure, and weight independent of its cause. The common relief in irritable colon by belching is due to changes in intra-abdominal tension caused by the sudden downward thrust of the diaphragm and the release of any gas that may be present. Spasm is thus broken and relief temporarily ensues. Practically all patients will insist that they do not swallow air. That they do can easily be demonstrated by physician and patient as well, under the fluoroscope. This may be fortified by the knowledge that unless an alkali be taken by an individual with free acidity, no gas is formed in the human stomach unless there is high grade obstruction with stagnation of food over at least a twelve-hour period, so that fermentation has time to become active. Thus, unless a patient has obstruction or takes an alkali, any gas in the stomach *must* be swallowed air.

The prevalence of "gas tablets" and "indigestion relief" medicines—most of which are soluble alkali—is mute proof of the extent of popular commitment in this question.

Pressure against the heart, or "pain in the heart," is due to cramp in the splenic flexure, with distention at times. The patient may have no idea that the colon comes as high as a broad hand's breadth below the left axilla in most persons, and he naturally refers to the pain as "heart pain." Anxiety may set up tachycardia or a shower of extra-systoles, and then he is certain that he has heart trouble. A second and perhaps more common cause is

distention of the fundus by air swallowing, with pressure upward against the diaphragm and consequent embarrassment to the heart. I have noted marked dislocation of the heart under these circumstances, with return to its normal position on belching the gas out. It is interesting to note that such dislocation may occur in some patients with no discomfort whatever, while in others a train of very disconcerting symptoms is set up.

"Hyperacidity" and burning are often due to the regurgitation of normal acid content into the esophagus. The esophageal wall normally does not have acid on its surfaces and is irritated by it. Frequently spasm is induced in the cardiac portion, and a mouthful of the material is forced into the mouth, which at the moment is the path of least resistance. The regurgitation is usually induced by an attempt to belch or by the semi-involuntary hiccough so frequently seen in "dyspepsia." Burning of this type may come on one or two hours after eating, and superficially simulate ulcer distress. The time of onset in this instance is dictated by the fact that uncombined acid is usually at its peak at this time and, also, the head of the residue column of the previous meal is beginning to distend the cecum. If this residue is irritating enough, distress ensues, belching for relief starts, and burning results. However, burning under these circumstances differs from that of ulcer in that it is present for only a short period, and disappears if the acid is washed down by saliva, water, or food, to recur as soon as material is ejected through the cardia again. Most significant of all, it always follows belching, hiccough, or any degree of diaphragm spasm under any other term.

The burning that is felt across the abdomen is more directly traceable to hyperperistalsis. It may come on immediately after meals, it is intermittent, likely to be diffuse, and moves around in the abdomen. It is influenced by alkali only if belching follows.

Rectal pathology—fissure, hemorrhoids, infected crypts, and ulcer—occurs as a result of loose stools induced by the repeated use of catharsis much more frequently than is generally appreciated. Because a hard stool causes pain and aggravates conditions after the pathology is present, many are led to the belief that the trouble is primarily due to that. Most patients very carefully keep the stools loose to avoid pain at stool, thus keeping up the process. A rectum regularly passing well-formed stools is rarely the seat of pathology. Pelvic pressure, pregnancy, and portal disease, of course, can cause hemorrhoids independent of rectal irritation. Likewise, rectal pathology often heals, if it is possible to keep the stools formed.

One of the most important details of the patient's history is the character of the stool. In only the occasional case due to mental reflex is the stool normal in caliber and consistency. Stools that are watery, mushy, ribbon-like, small, and chunky and in the form of small balls are all evidence of spasticity. Bran stools are often bulky, mushy, and gas-containing. Mineral oil stools are likely to be small in caliber and snake-like. Salines and more active drugs cause the stool to be mushy or frankly watery. The duration of symptoms, type of cathartic, frequency of its use and threshold are factors modifying the kind of stool produced.

The diagnosis of irritable colon is based primarily on an interpretation of symptoms as they mirror pathologic physiology. As is true in the diagnosis of any functional disorder, objective evidence, physical examination, laboratory and x-ray study are more valuable in excluding organic disease than in proving the functional.

Physical findings of diagnostic import are limited largely to palpation of the colon. Normally, this organ cannot be made out by the palpating hand. In irritation with sharp contraction of the musculature, the sigmoid may be rolled under the fingers—this is particularly true in the cathartic cases with loose stools. The bowel is tender, at times exquisitely so. The pain may be referred to the epigastrium. In cases in which hard stools are the rule, the cecum

may be the most easily palpable, and tender. Often in severe cases the entire colon can be mapped out as a tender, rope-like cord. Patients will usually recognize the tender colon as the source of pain. No other patient is so "abdomen-shy" as a typical severe irritable colon case. If spasm does not happen to be present at first, the bowel may be "rubbed up" and irritated into activity, usually to the manifest discomfort of the patient. Although some conscious muscle defense is shown, true rigidity is never present. Sphincter spasm, severe enough to suggest stricture, may be encountered. Proctoscopic examination shows nothing except a blush of the membrane and whatever incidental rectal pathology may be present.

The rest of the physical examination adds nothing directly save points of negative import. However, organic conditions of great importance as contributing factors in the etiology of the condition are often seen. Circulatory disease, and such constitutional conditions as tuberculosis, may be masked by complaints due to colon dysfunction. However, a complete physical examination should always be done.

Temperature, respiration, and pulse are normal. Studies of the blood, urine, etc., are negative. Stool examination of value is limited to observation of the consistency and form, outlined previously as indicative of spasm. Mucus as a reaction to irritation is often present. At times, great strings or casts of the bowel may be seen. There is no blood or pus in the uncomplicated case. In the fermentative type, the stool is mushy, bubbly, floats on water, and smells sour: *Clostridæ* may be seen microscopically: set up in a Schmidt tube, the excess gas formation can readily be demonstrated. This type of stool is always acid in reaction. The putrefactive stool is alkaline, and has the characteristic odor of indol, phenol, and scatole. This latter type is not important clinically.

Bacteriology of the stool is so complicated that it is rarely accurately done, clinically. Except for the recognized organisms causing actual pathology, the bacteria present are of very little diagnostic significance. Overgrowth of the gas-formers in fermentive colitis may be demonstrated: the same is true of the putrefactive organisms in that condition.

X-ray Studies.—What is done and how it is done are dictated by the clinical features of the case. In justice to the roentgenologist, all of the clinical data should be in his possession, that he may study the case and interpret the x-ray evidence clinically in the light of that knowledge. Thus, the roentgenologist becomes a clinical consultant in his specialty instead of a laboratory technician submitting "blind reports." The value of x-ray evidence would be greatly enhanced if this practice were even more generally followed.

X-ray evidence is most satisfactory when the barium enema is employed. As the enema is started, the rectum often balloons. Suddenly the column will streak up into the sigmoid, showing a narrowed lumen as far as the transverse colon. There may be a point where spasm can be visualized, with a tendency to balloon behind. Haustræ are seen, but the markings may be shallow. In the middle and right half of the bowel, haustral markings are more likely to be within the limits of normal. As the bowel is completely filled, certain areas, particularly on the left, may show spasm, forcing the material in either direction and leaving a section of the bowel with no barium showing. Study of the wall with the bowel full shows no constant defect, and, with time, all of the lumen can be seen to fill out. The contour, length, and configuration of the colon, in the absence of a defect or signs of organic obstruction, have no diagnostic significance. A long bowel with marked redundancy and so-called "kinks" will function normally, and show no symptoms in the absence of other factors causing motor disturbance. The position of the bowel in the abdomen is not of itself the cause of bowel dysfunction. "Ptosis" should be abandoned as a clinical diagnosis, if we are to assume that the ptosis is causing symptoms. It represents a build—the patient's habitus —not an acquired anatomic abnormality.

Significance can be placed on the actions of patients as the enema runs into the bowel. Many spontaneously exclaim that they cannot hold it, that it is producing the characteristic pain which brought them in. With expulsion, relief is experienced.

It is best to administer the enema without previous catharsis or enemas. At most, a plain water enema to clear the lower bowel should be used. Thus any possible spasm which might be set up by such procedures will not confuse.

The x-ray study is of especial value in ruling out organic pathology. Its value in a positive way is suggestive, not definitive.

Clinical "Earmarks" and Tests in Diagnosis.—It is sometimes necessary, in order to clarify history, to place the patient on a fairly coarse diet and check on the distress in every way possible. Under these circumstances, the time relationship and the reaction of the patient to alkali, food, and enemas when he has distress can be verified. In obscure cases, with severe distress, the "test enema" may be employed. At the height of the pain, the patient is given a three-quart enema, one pint at a time, all the water to be retained if he can. As each pint is run in, he describes to the nurse his sensations. If he can retain it, he notes what happens on expulsion. The characteristic response is that a pint or two makes the distress so severe that he can hold no more: relief comes with expulsion. It is necessary to know that the distress caused by the enema was the "old pain" made worse. If there is no influence whatever on the pain, the bowel is almost certainly not the source. If the distress caused was a "new pain," the same is true. A few patients get relief as spasm is broken by the entrance of the water—they are likely to have more severe pain after expulsion, as it takes hold again. In acute cases with grave possibilities in the diagnosis, such a test should be done by the physician himself and with circumspection. I have found the test of value both positively and negatively in almost all of the sources of abdominal pain.

Differential diagnosis at times is exceedingly difficult because the manifestations are so protean. What Osler said of syphilis is equally true of irritable colon as far as abdominal symptomatology is concerned. The distress is not always distinctive—the frequency with which the condition is superimposed upon other syndromes, due to popular therapy—the frequency with which organic states not producing symptoms are found, and the fact that some portion of the colon is an intimate neighbor of practically all of the other symptom-producing viscera, all serve to complicate the clinical picture. Many of the associated symptoms are as frequently found playing the same rôle in other diseases, as, for instance, belching in ulcer, gall-bladder disease, heart disease, etc.

The most common conditions in which errors are likely are: chronic appendicitis; acute appendicitis; gall-bladder disease; ulcer; heart disease; urinary tract disease; gastric crises, and neurologic lesions.

In appendicitis, the irritable colon is never accompanied by fever, leukocytosis, or the true rigidity. However, muscle defense, especially to pain caused by palpation, is common. Vomiting is not common unless headache is present. Colon symptoms run along day after day, any flare-ups being due to recognizable causes in most instances. The pain that moves about in the abdomen is often associated with rumbling, and the passing of gas with relief: the sigmoid is palpable and often just as sore as the cecal area. There is a definite history of bowel mismanagement and abnormal stools, and finally, on proper management, the pain disappears. It must be remembered, however, that since both appendicitis and irritable colon are common, they may occur in the same patient. However, there are many appendices removed without relief in these cases. Many times the acute appendicitis is merely an incident in the life of the patient, but not at all connected to the colon disturbance. There would be less confusion if the irritable colon syndrome were better recognized, and if the attack with fever, etc., in the history, or present complaint, however mild, were

more closely depended upon. In patients with irritable colon, in whom acute appendicitis occurs, the difference in the two pains is recognized. The patient often says: "I never had this sort of pain before." It is not necessarily the severity of the pain that makes the difference, either.

In the case of gall-bladder disease, what has been said about appendicitis holds true. The gall bladder has long been given credit for the production of symptoms which it cannot produce. Its symptomatology is not as vague as is generally taught. Confusion due to symptoms referable to the bowel and other organs, is responsible for this. Medication for the "liver"—salts, calomel, bile salts, etc.—are all purgatives, and it is the rare instance of suspected gall-bladder disease that is not treated by one or the other of the laxative preparations. Thus, except for the first attack or isolated attacks, a complication is nearly always present. With the advent of better gall-bladder films in x-ray study and the use of the dye, more and more "silent" pathology in the way of non-filling and stones is being brought to light. It must be remembered that gallstones are commonly found at autopsy in patients in whom no symptoms suggesting their presence were found in life. There are far more silent stones than symptom-producing stones. It may be permissible to remove obvious pathology in these cases, but it is not permissible to assume that the patient will be well if his symptoms were not due to that pathology. Most of the unsatisfactory results in gall-bladder and duct surgery are on this basis. If the suspected gall-bladder case has no evidence of bowel disturbance, the picture can usually be made out. In those cases of long standing, with the bowel function corrected, gall-bladder symptoms, if present, will show up with sufficient clarity to warrant a correct diagnosis if the patient is under reasonably accurate observation.

Due to the prevalence of laxative alkali (magnesia) treatment, self-medication, especially in most ulcers of any standing, the patients are prone to acquire colon disturbances. Too, ulcer is common in the vegetative nervous system type of unstable individual who is also prone to bowel disturbance. Usually, in spite of the admixture of symptoms, the ulcer condition can be proved. At times, however, it is necessary to correct the bowel condition first, so that the picture of ulcer may stand out in relief in order that it may be recognized. Most of the unsatisfactory results in ulcer management come from the aftermath of prolonged use of magnesia in alkalinization, and analysis of the symptoms will prove them to be colonic in origin. Most intelligent patients recognize the difference in the distress very readily. Many an ulcer patient has had a gastro-enterostomy done on the basis of the x-ray defect due to scar, when the symptoms were caused by the colon.

Decompensated hearts and coronary hearts often present themselves with the complaint of "indigestion." Here again failure to recognize the origin of distress leads to the use of "gas tablets," etc., and the addition of discomfort through irritation of the gastro-intestinal tract. Early decompensation, unrecognized for months, commonly gets into a welter of mixed-up symptomatology which must be untangled and the origins properly placed. The practice of using salines to promote water-loss by bowel often causes more harm than good, due to the cramp and embarrassing distention produced.

Disease of the ureter, in which urinary findings, bladder and ureteral symptoms, and the characteristic radiation are absent, may be covered up by bowel symptoms. Cases in which nagging pain persists after bowel management are often due to stricture of the ureter. Usually this pain is fairly well localized and, if carefully watched, will show enough urinary tract symptoms, radiation, desire to urinate, frequency, or relief from emptying the bladder, to warrant suspicion of the kidney and ureters so that appropriate diagnostic procedures are introduced and the lesion discovered.

Disease of the colon itself—carcinoma, diverticulitis, and infections—must always

be ruled out. The presence of blood and pus in the stool, fever, localized pain, etc., coming on "out of a clear sky" or in attacks, should immediately suggest laboratory and x-ray examinations, with endoscopy to clear up the diagnosis. This is especially true in the cases of middle-aged patients who have had no previous colon disturbance and in whom none of the features of mismanagement of the colon can be made out.

Diseases of the rectum and pelvic organs should be revealed in the routine examination, which all patients with abdominal complaints should have.

Treatment of the condition involves, first of all, an appreciation of the pathologic physiology involved. All treatment is directed toward the re-establishment of normal physiology. The multiplicity of "trigger factors" of necessity leads the physician not only to drug therapy and dietetics, but psychiatry, economics, and sociology as well. The scheme of things must be sedative in type because of the nature of the disorder. Irritants of all types must be removed or ameliorated. With but few exceptions, there must be no compromise with the dictum of "no cathartics," however mild they are supposed to be. Mediocre results are the price of any lack of rigidity of purpose. The patient must be taught how to manage his bowel; he must understand enough gastro-intestinal physiology so that he can handle the ordinary variations in detail that come to any individual, and not do the wrong thing. At times it will tax the patience of any physician to attempt to correct the ideas that got the patient into trouble in the first place. Much of normality is so opposed to what has become traditional, and has been hammered into the popular mind by quacks and advertising, that it is no wonder it is hard to convince some people, that one is in line with the truth. The element of time enters in: a condition of months' or years' standing cannot be expected to subside quickly. Flare-ups during management are common, and are often of value as "horrible examples" in the re-education of the patient. Gradually the victim learns and believes and thus most of the battle is won. Fortunately, even the most terrifically abused colon, if anatomically intact, can be quieted down and made to function normally on food alone.

MANAGEMENT

Diet.—The diet may consist of ordinary bland food, with interdiction of those articles known to be possible irritants. Examples of potentially irritating articles of diet are: coarse vegetables, as cabbage, corn, cucumbers, onions, radishes, cauliflower, baked beans; fruits—all raw fruits, with the possible exception of oranges and grapefruit, honey, cider, soft drinks, chocolate, syrups, beer, ale, and wine.

There are many individual reactions to articles of diet which must be worked out for each case. In many instances the patient is wrong in his interpretation of what causes trouble, but it is always best not to cross him when it can possibly be avoided—he may be right.

The diet should contain a sufficient quantity of non-irritating residue to produce a normal stool. At the start, this may be best accomplished by the use of those vegetables commonly fed to young children. In severe cases, they may be puréed; in all cases they should be well cooked.

Constipation must be understood to mean the passing of hard and dry stools. Absolute regularity is not insisted on. If the stools are constipated on a diet containing two ordinary helpings of vegetables, the *quantity* of vegetables is gradually increased to the point where the stool is no longer hard and dry. Distress, as a rule, lets up as the character of the stool approximates normal. If the stool is still hard and dry, and the patient can take no more vegetables, it is permissible to add fruit if there is no distress. Should there be a recurrence of distress following any addition of vegetables and fruit, it is usually wise to drop back to the former diet. The patient thus gradually works his way to what, for him, is a normal diet. Most patients can

get back eventually to a fairly average normal diet. There are, however, so many individual reactions to foods, due to appetite, likes, and dislikes, that each case must be worked out as it progresses. Each patient must be taught the rules of the game as they apply to him. Some are permanently restricted in their intake of certain foods by the limitation of hyper-irritability of their colonic mechanism.

Drugs.—Useful drugs are of two types, anti-spasmodics and sedatives. Belladonna and hyoscyamus preparations may be used. The dosage should be up to tolerance. In my experience, anti-spasmodics have not been uniform in their effect: drugs to depress nervous irritability, preferably of the barbituric group, are likely to be of more value. Steady use over ten-day periods with an interval of a few days, is often advisable over a couple of months' period. This is especially true in the vegetative unstable group. Bromides are too prone to cause skin rashes if used in adequate dosage for very long. Powders containing salts of bismuth and calcium are valuable in some instances in slowing down peristalsis, in the effort to get a formed stool. Opium should be used only in acute cases of short duration in which there are severe pain and diarrhea, not controllable by other means.

Physiotherapy.—Heat in any form is the most effective anti-spasmodic. It may be applied to the abdomen in the form of a pad or hot water bottle, especially after meals. It may be used each alternate half-hour throughout the day. In a few cases, heat seems to stir up peristalsis. Hot tub baths may be used if care be taken to avoid circulatory depression. Friction massage of the body, particularly in the elderly and debilitated, is of value as a sedative: it should not be used on the abdomen. Deep pressure or kneading of the abdomen is to be avoided. Supports, corsets, and belts of many types have been advocated, especially in the ptosis cases. However, on fluoroscopic check-up, it will be seen that the ptosis in most cases is unchanged. On the contrary, I have seen many instances in which the pressure forced the viscera lower than they lay normally. That these appliances often afford a measure of relief is granted, a relief from two sources: first, counter-pressure, just as the youngster with green apple colic gets relief from putting his elbows across his lower abdomen and doubling over; second, the soothing effect of the heat produced. Many patients are aware of the increase in discomfort when the abdomen is cold and of the relief from warmth, and wear heavy abdominal binders.

Changing the intestinal flora by the administration of acidophilis milk, etc., has been of only slight value, and then only in fermentative cases. On the other hand, I have seen many cases made worse by the laxative influence of the milk. Fermentative processes are best controlled by rigidly curtailing the carbohydrate intake and the use of alkaline powders. In putrefactive cases, the protein is cut down. Otherwise, in both types the management is the same as outlined above.

Psychiatry.—Cases in which emotional conflict is a factor are common. Often the disturbance can hardly be termed psychiatric. Fear of disease, irritations and troubles which would be spontaneously adjusted in a less highly irritable person, should be patiently and without levity "ironed out" and explained. However, unless the physician has some sound understanding of emotional mechanisms, great care must be exercised. Superficial explanation, moralizing, or illogical use of suggestion may be worse than failure. In many instances, the difficulties do veer toward the more complicated psychopathologic and should be referred to those specialists more competent to deal with such problems. Often the general medical management may ameliorate the condition somewhat without treatment of the emotional angle, but as a rule not much permanent headway is made. Just what influence the mental problem has on the colon condition dictates what must be undertaken and what the result is likely to be.

Treatment of rectal pathology in some cases must precede any attempt to manage the colon.

Finally, such commonsense matters as sufficient sleep, rest, outdoor exercise, water intake, posture, care of the teeth, etc., should be emphasized in the interest of removing all possible sources of irritation.

Since, under normal conditions only the lower foot or so of the bowel empties with a normal movement, that segment is the only one we have a right to interfere with. Thus a stool may be induced legitimately by (1) a small plain water enema of 8 to 12 ounces, (2) a cocoa butter suppository, or (3) a three to four ounce olive oil enema. At times the oil enema is more effective if introduced at night and retained until morning. Leakage is often a nuisance, however. If a small water enema fails to get a result, it may be repeated, but no more than one pint should be used. Unless there is rectal discomfort, it is often better to advise the use of the enema on the second day instead of daily.

Exceptions to the use of laxative drugs, bran, mineral oil, etc., may be listed as follows: the aged, patients with organic nervous lesions, and temporary conditions such as perineal operations, hemorrhoidectomy, etc. When used, care should be exercised that the type of stool obtained is as close to normal as possible. In the event that soft stools are desirable post-operatively, the patient should be told of the reason for the use of mineral oil, etc., and advised concerning discontinuance of artificial aids to bowel movements later.

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SCHÜLLER-CHRISTIAN DISEASE

AFTER X-RAY THERAPY, LIVING AND UNDER OBSERVATION ELEVEN YEARS[1]

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THE case here described is the form of xanthomatosis (1), known as Schüller-Christian's disease, exhibiting "defects in the membranous bones, diabetes insipidus, and exophthalmos" (2), Rowland has shown that this disease belongs to the general group of lipoid disturbances which include Niemann-Pick's, Goucher's disease, and cutaneous xanthomatosis. He believes it is a primary constitutional change affecting lipoid metabolism, and perhaps a superimposed dysfunction of the liver and lungs resulting in excess accumulation of lipoids in the blood and body fluids, and then in massive storage or infiltration in the tissues. This he supports by findings in animal experimentation of cholesterol feeding. Our case belongs to that sub-group which is characterized by excess cholesterinemia, by occurrence in childhood usually between the ages of two and fifteen years, by defects in the flat bones, and a sequence of other signs depending on the location of the deposits. It is obvious that the deposition of the lipoid and production of bone defects take precedence, and that a sequence of signs and symptoms appears as this process encroaches on other organs by pressure. Thus unilateral or asymmetrical exophthalmos, diabetes insipidus, dwarfism, or adiposogenitalis may follow. It is a progressive disease, occasionally showing spontaneous remission, and frequently being fatal within from two to four years. The patient here described is now 13 years of age, and his condition is apparently arrested. The case corroborates the findings of other writers (3), that the disease does not necessarily show the triad of Christian's syndrome simultaneously, but that the earliest of the three usually is bone defect. In this case the sign which directed attention to the bone lesion was a localized area of slight skin elevation on the left forehead. The report furthermore adds evidence to the efficacy of roentgen treatment in this disease.

Fig. 1. Taken one year before the first symptom appeared; the patient was normal and well nourished.

CASE REPORT

Case 1. T. B., a white male child, aged 21 months, was first referred to me by Dr. Andrew J. McGowan, of New Brighton, N. Y., on June 20, 1923. The mother had observed the child putting its hand to the left frontal region where there was an area of scarcely perceptible elevation of the skin, about 2 cm. in diameter. In appearance it was soft and unchanged in color. The child was well nourished, normal in size and weight, and of good color. Figure 1 shows him about one year before examination.

[1] From the X-ray Department, St. Vincent's Hospital, Staten Island, N. Y.

Fig. 2-*A*. Fig. 2-*B*.

Figs. 2-*A* and 2-*B*. Single lesion in left frontal bone; films taken June 20, 1923.

Both parents are Irish-American. He weighed 8 pounds at birth. His first teeth appeared at three to four months; he walked at ten months, and had measles at six months.

Fig. 3-*A*. Taken 18 months after Figures 2-*A* and 2-*B*. Exophthalmos was most marked in the left; there was a depression of the lower eyelid; double chin; mouth breathing (Jan. 4, 1925).

Roentgenography showed a circular area of bone defect—1.7 × 1.3 cm.—in the left frontal bone, just anterior to the fronto-parietal suture (Figs. 1-*A* and 1-*B*). The outline of this area was irregular. The sella turcica was normal in size and the clinoid processes intact. The teeth in the maxillæ were normal. The bones of the forearms and legs, including their epiphyses, were normal. The blood Wassermann of the child was negative, and also that of the father and mother. At this time (1923), the child lacked the triad of signs described by Christian, in 1919. He did not have exophthalmos nor polyuria. A Von Pirquet test was found to be very strong. Since nutritional bone dyscrasias and syphilis were excluded, and no other evidences of disease were present, it was thought to be of tuberculous etiology and, therefore, no treatment except hygienic measures was advised. The mother reported that soon after she first brought the child to the hospital a "canker sore" had appeared on the left upper gum, and that the teeth had become loose, some of them having to be removed. The skin elevation on the left temple had disappeared in about four months without treatment.

The patient was not seen again until Dec. 26, 1924, when he was re-admitted after an interval of one and one-half years, at which time he was three years and three months of age (Figs. 3-*A* and 3-*B*).

Fig. 3-*B*. Taken at the same time as Figure 3-*A*. A "geographic skull," with erosion of the sphenoid body and floor of the sella.

A physical examination revealed an exophthalmos of both eyes, being most marked in the left. His teeth were loose, some extruding from the gums. There was mouth breathing, nasal obstruction, and drooling. The patient had a double chin and a pot belly. Temperature, pulse, and respiration were normal. The head presented no tumors, but irregular soft areas, some of them transmitting pulsations. Heart and lungs were normal; liver and spleen were normal. His blood count was: hemoglobin, 65 per cent; red cells 4,720,000; leukocytes 8,200; polymorphonuclears, 60 per cent; large lymphocytes, 10 per cent; small lymphocytes, 28 per cent. Red cells show no variation in size and shape; there were many with pale centers. Blood Wassermann was negative; blood urea nitrogen was 9 mg.; calcium was 10.9 mg., phosphorus was 5.4 mg., and spinal fluid Wassermann was negative.

A urinalysis revealed the following: acid, faint trace of protein; specific gravity, not obtained; no Bence-Jones protein (repeatedly negative later).

Roentgenography showed a very marked destruction of the bones of the vault, consisting for the most part of large coalescent areas of rarefaction of the typical "geographic" type, and of few small, discrete lesions. The areas were of irregular shape, and most of them had irregular, jagged outlines. The sella turcica showed changes in shape; its floor was interrupted, and its posterior portion was higher than its anterior. The body of the sphenoid bone showed absorption throughout, apparently due to the same process. The bone septa of the nasal sinuses were atrophic and irregular. The mandible showed the outlines of con-

dyles and rami, and of the inferior border of the body. Disalignment of the latter, in the anterior part, indicated fracture. The alveolar margins were not visible. The radiolucency within the body and rami was presented two small areas in its posterior part. Epiphyseal development at that time was normal.

Although Danzer's case (4), published a month earlier, called our attention to the

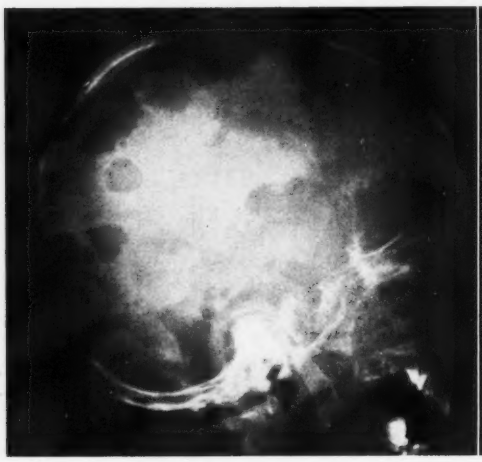

Fig. 4. Taken six weeks after Figure 3-*B*. Pulsations were palpable.

Fig. 5. Taken five months after beginning of treatment (Oct. 7, 1925). There was marked improvement, and an increased thickness of the mandibular border.

Fig. 6. Taken at the onset of polyuria (May 24, 1926).

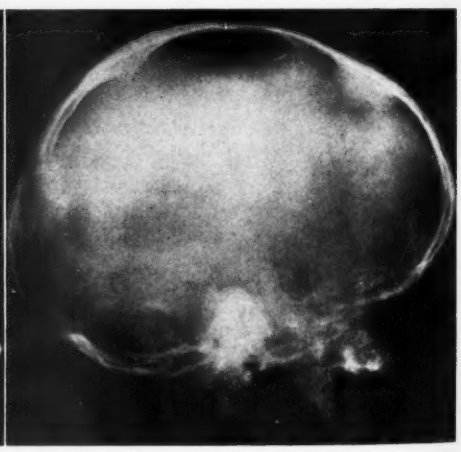

Fig. 7. Taken three and one-half years after the beginning of treatment. There was still incomplete recalcification at the vertex and in the floor of the anterior fossa (Aug. 1, 1928).

suggestive of absorption of the same type as in the vault. The right iliac bone showed one irregular area, 2.2 × 1.3 centimeters. The third rib on the right side also

similarity of our case to Christian's syndrome, it was not yet identified as such because our case did not have polyuria. Diabetes was then thought to be an essential

sign of that condition. Therefore, it was concluded to be a form of myeloma or some obscure metastatic malignancy. Dr. James Ewing, after viewing the radiographs, advised against the taking of a biopsy and urged the institution of x-ray therapy.

X-ray therapy treatment was begun on March 4, 1925, with the following factors: 9-inch point spark gap, 5 ma., 10 inch distance, 4 mm. A l filter, 4 or 5 minutes each. With this set-up, 10 minutes gave an erythema. The treatments were of relatively low voltage, and spaced about one month apart.

Before treatment was begun, progression of the disease could be seen in an interval of six weeks (Fig. 4). In some of the areas pulsations could now be felt. About five months after the beginning of treatment (Oct. 7, 1925), during which time eleven applications had been given to the skull, there was marked improvement (Fig. 5). The discrete lesions were smaller; the large area in the temporo-fronto-parietal region showed considerable filling in. The body of the sphenoid was also almost solid. The sella turcica was altered in shape, its clinoid processes being absent. However, some lesions at the top of the skull were more sharply defined, with smooth outlines, and through them pulsations were transmitted. The mandible showed considerable improvement, with thicker, dense borders. Also the septa of the nasal sinuses were denser.

Polyuria was not noted until 14 months later (May 10, 1926), and persisted for 10 months. During this period there was polydipsia, anemia, loss of appetite, and marked loss of weight, the latter decreasing from 35 pounds to 27. When it ceased, the patient improved rapidly and gained six pounds in two weeks. He had received 19 applications of x-ray to the skull before the onset

TREATMENTS																
Skull										Ilium				Ribs	
Right	Min.	Left	Min.	Face	Min.	Occip.	Min.	Ant.	Min.	Post.	Min.	Post.	Min.
3-4-25	4	3-6-25	4	3-11-25	4								
3-30-25 (A)	4	3-30-25	4										
4-28-25	4	4-28-25	4	4-11-25	4	4-11-25	6						
6-8-25	4	6-8-25	4	5-16-25	5	5-16-25	5						
8-26-25 (B)	4	8-26-25	4	8-26-25	4								
10-24-25 (C)	5	10-24-25	5	10-24-25	5			(J) 10-9-25	5	10-9-25	5		
								12-23-25	5	12-23-25	5		
								2-18-26 (K)	5	2-18-26	5	1-27-26	5
(D) 6-17-26	5	6-17-26	5										
		7-12-26	5										
								(L)					
12-23-26 (E)	5	12-23-26	5										
1-25-27 (F, G, H, I)	5	1-25-27	5			Vertex 2-25-27	5						

A—Epilation began 4–11–25. Hair has all grown in since.
B—Improvement after 11 treatments to skull. Sphenoid body filling in (Fig. 5).
C—Enucleation of left eye, 11–13–25.
D—Polyuria first noted, 5–10–26.
E—Polyuria decreased, 1–12–27.
F—Polyuria subsided, 3–18–27.
G—Four months after last treatment to skull the parietal areas recalcified.
H—Three and a half years after beginning treatment there is still incomplete recalcification at vertex and in floor of anterior fossa (Fig. 7).
I—Figure 8 shows complete calcification, 10–25–33.
J—Ilium before treatment shows progression of the disease from 12–27–24 to 10–7–25 (Fig. 11, *A* and *B*).
K—Nine months after treatment, (Fig. 11, *C*).
L—Eight years after treatment, (Fig. 11, *D*).

of diabetes, and eight more during its course.

About two weeks after the onset of polyuria (May 24, 1926), there was a little more evidence of ossification in the vault bones and mandible were short and small (Fig. 8).

On Dec. 27, 1924, the lesion in the right ilium was first demonstrated in the course of routine examination. It was 21 × 13

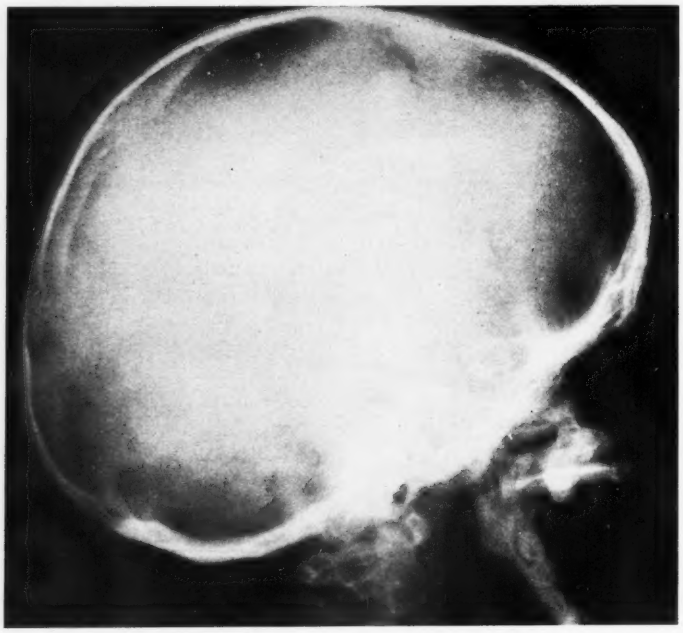

Fig. 8. Complete recalcification at twelve years of age (Oct. 25, 1933).

lesions, but the area in the base of the anterior fossa was more marked and enlarged. The septa of the nasal sinuses were less dense, and the mandible showed decreased thickness of the dense borders (Fig. 6). On Jan. 12, 1927, polyuria was reported decreased, and was entirely absent by March 18, 1927.

When the patient was seen on Aug. 1, 1928, there had been no recurrence of diabetes. There was apparent slight improvement of the exophthalmos since he was now able to close the eyelids (Fig. 7). The lesions in the skull were well calcified except on the left side at the vertex, and to some extent at the base of the anterior fossa. At 12 years of age (Oct. 25, 1933), there was complete calcification. Facial

mm. along the outer anterior border; the border was intact, and the whole thickness of bone was not involved.

Ten months later, on Oct. 7, 1925, just before treatment was begun on this area, it showed extension through the whole thickness of the bone and through the lateral border, measuring 26 × 16 millimeters.

On Nov. 30, 1926, nine months after a series of six roentgen applications, there was definite evidence of some regeneration of the lateral border as well as increased density of all the border, and the size of the lesion was reduced to 19 × 7 mm. (Fig. 13).

Two and one-half years after the treatments, Aug. 1, 1928, the lesion was almost completely filled in, there being a little

thinner triangular area 8 × 5 mm. still visible.

Apparently the progression of the lesion stopped at the time the treatment was given and the calcific replacement continued slowly thereafter. On Oct. 25, 1933, at 12 years of age, the area was completely calcified (Fig. 10).

In the third right rib, there were two areas 5 mm. in length. These received one treatment on Jan. 27, 1926. Ten months later the lesions were scarcely visible.

The exophthalmos of the left eye was so great before treatment was instituted that the eyelids could not be closed. This was slightly improved after 16 treatments to the skull had been given, so that the eyelids could be closed by voluntary effort. However, on Oct. 24, 1925, the condition became aggravated, and the eye infected. Pus appeared in the anterior chamber. On Nov. 13, 1925, enucleation was performed by Dr. Charles W. Kinney, who thought the condition was a retrobulbar sarcoma with superimposed infection. At operation he found no evidence of newgrowth, but the orbit was markedly contracted, and the upper posterior wall was pushed forward. Convalescence from this operation was uneventful. Five months later, the other eye was slightly inflamed and showed a corneal ulcer. Because of the patient's inability to close the eyelids, the cornea was exposed to irritation from the pillow during his sleep. At the suggestion of Dr. John N. Evans, of Brooklyn, the eyelids were kept closed at night by adhesive tape. The inflammation subsided, and the ulceration was checked. It is obvious that the acute condition in the left eye, leading up to enucleation, had also been due to extrinsic irritation and infection. (See tables next column.)

The patient is now 13 years of age, free of symptoms, and quite active. He attends school, and plays vigorously with other children. He is considerably dwarfed, 51 inches in height, and weighs 57 pounds (Fig. 9). The right eye still shows exophthalmos. The mandible is under-developed as are also the facial bones. He shows no tendency to obesity. The geni-

Fig. 9. Taken at the age of 12; a comparison of stature with that of a brother 18 months younger.

Cholesterol examinations of the blood, made in 1933, were as follows:

Feb. 18, 1933	260 mg.
July 8, 1933	300 mg.
Oct. 23, 1933	219 mg.

Basal metabolism on Oct. 20, 1933, was 7.0 below. Blood analysis on Oct. 23, 1933, was as follows:

Sugar	0.099	per cent
Urea N	8.4	mg. per 100 c.c.
N. P. N.	21.5	mg. per 100 c.c.
Uric Acid	2.34	mg. per 100 c.c.
Calcium	13.1	mg. per 100 c.c.
Phosphorus	8.2	mg. per 100 c.c.

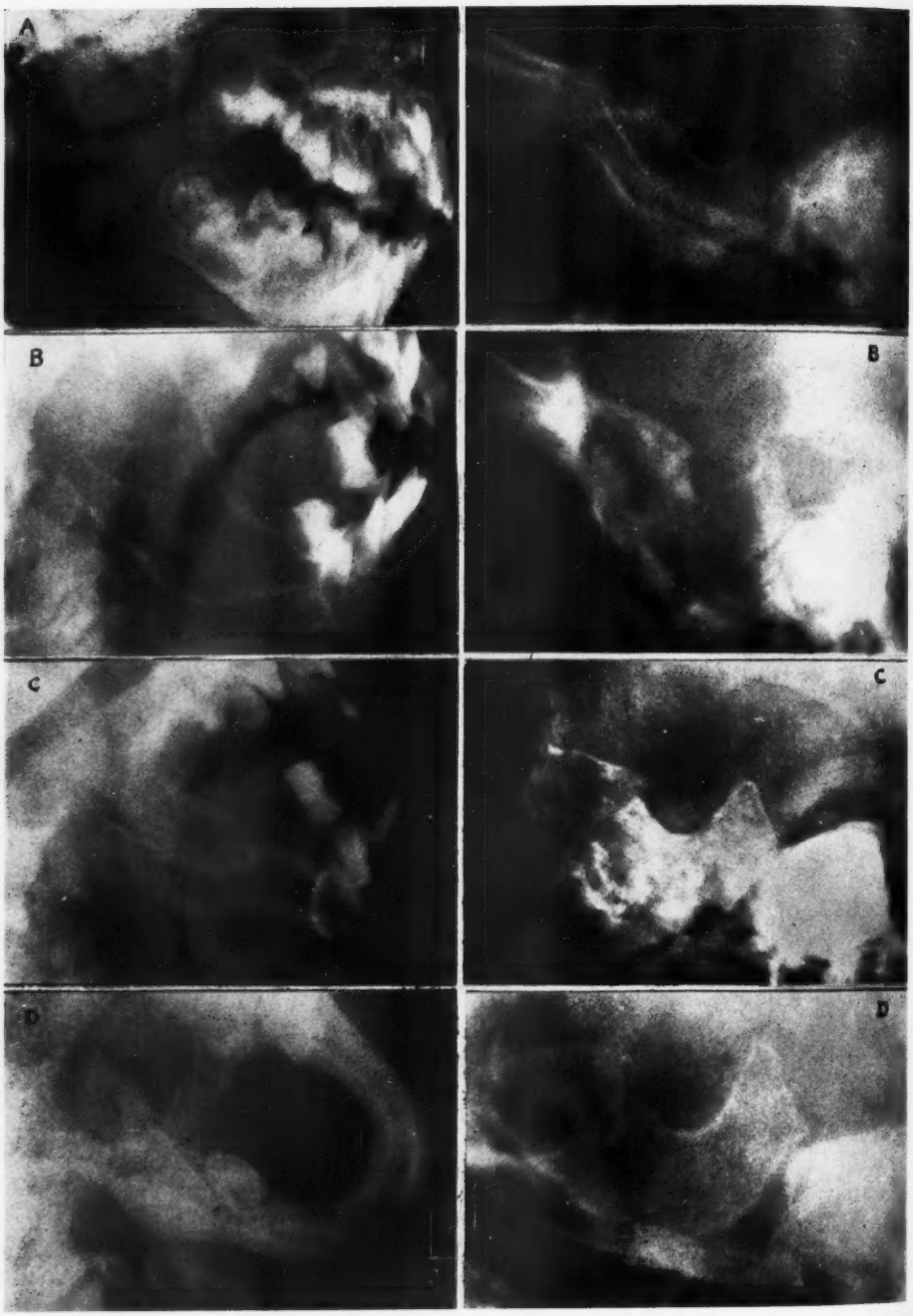

Fig. 10. (*A*) Normal mandible, sella, and sphenoid body. At that time, June 20, 1923, there was a single lesion in the skull. (*B*) There was a marked destruction in the mandible, the pathologic fracture probably accounting for the double chin. Some teeth may be seen extruding from the alveolus. The sphenoid body was eroded, the floor of the sella fractured(?) (Jan. 4, 1925), same as Figure 3. (*C*) Improvement, Oct. 7, 1925, same time as Figure 5. The sella turcica was of altered shape, but regular; the sphenoid body recalcifying (May 24, 1926). Onset of polyuria. (*D*) Mandible completely recalcified, but dwarfed. Sphenoid body well calcified (Oct. 25, 1933).

tals are normal, but have not shown changes of puberty. There is increased hirsutism on the forearms. His long bones are normal, but epiphyseal development is retarded about two years.

Fig. 11. (*A*) Taken before treatment (Dec. 27, 1924). (*B*) Progression of disease during nine months before treatment (Oct. 7, 1925). At this time the skull showed improvement after treatment (Fig. 5). (*C*) Nine months after six treatments (Nov. 30, 1926). Definite limitation of lesion and some recalcification. (*D*) Eight years after treatment (Oct. 25, 1933), with complete recalcification.

DISCUSSION

Improvement in the bone lesions following roentgen therapy was at first not sufficiently convincing proof of the cause-and-effect relation, because of the length of time it took to recalcify the areas and because some areas remained uncalcified longer than others. However, it was later apparent that the signs of improvement were evident: the contour of each lesion was be-

coming even and there was cessation of expansion of the areas. The recalcification of the areas could be expected to be a slower process. The lesion in the ilium, which remained untreated during a period of nine months, showed definite progression of the destructive process, while in the same period the skull, which was receiving treatment, showed improvement. Furthermore, nine months after the ilium received treatment it also presented definite signs of improvement.

These evidences of the effect of roentgen therapy in this disease are similar to those obtained and convincingly demonstrated by Dr. Sosman in his cases (5). His bibliography and history of the evolution of this medical entity is very completely given (3).

In our case, all stages from the earliest to the most extensive have been seen. It is now well recognized that Christian's triad of signs is not essential in the diagnosis. A single small area of rarefaction, generally in the flat bones, and particularly in the mandible or the vault of the skull, may be the earliest x-ray finding. Clinical signs may be present or may precede x-ray findings, *e.g.*, ulceration of the gums, extrusion of teeth, and a chalky-white appearance of the teeth. Cholesterinemia should be looked for; x-ray therapy can be given as a test in doubtful cases. Later signs may be asymmetrical or unilateral exophthalmos, and soft areas in the skull, with or without pulsation. Polyuria may appear and may be transient. It is felt that if x-ray therapy is given early, loss of teeth, destruction of bone, and possibly diabetes and dwarfism may be prevented.

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TECHNIC FOR THE USE OF A SMALL CONE IN CHECK RADIOGRAPHS OF THE SPINE*

By GERTRUDE R. PEARSON, R.T., Greeley Hospital, *Greeley, Colorado*

SURGEONS and radiologists now require repeated x-ray examinations of a single fractured vertebra much more frequently than in the past. Many deem it necessary to observe the progress of healing and to make periodic checks of the position. The purpose, of this paper is to describe a method of centering accurately for a designated vertebra when using a fine cone.

It is necessary to use the smallest cone possible in addition to the Bucky diaphragm to best visualize the minute bone detail in the bodies of the spinal vertebræ. The reproductions of spine films illustrating this article are examples. A routine x-ray examination of the lumbar spine (Fig. 1)[1] was interpreted as only suspicious for a fracture of the body of the second lumbar vertebra. A check with a small cone (Fig. 2) revealed undoubted compression fracture of this vertebra. Figure 3, a check five weeks later, shows satisfactory position and beginning callus formation. The anteroposterior view taken with a small cone (Fig. 4) shows the line of fracture. In Figure 5, a routine anteroposterior view, the line of fracture was not visualized clearly enough to be reported.

The use of a fine cone is especially desirable when the patient is in a body cast, because the cast increases secondary radiation which diminishes contrast and, therefore, makes detail less visible. When the patient is in a cast it is impossible, unless the cast is very loose, to locate the point for centering by palpation of the spinous processes. This is difficult even when the patient is not in a cast. Some technicians overcome this difficulty by using the original anteroposterior view upon which to determine the distance of the designated vertebra from a landmark easily palpated, such as the pubic symphysis, and mentally estimate the distortion present. This is

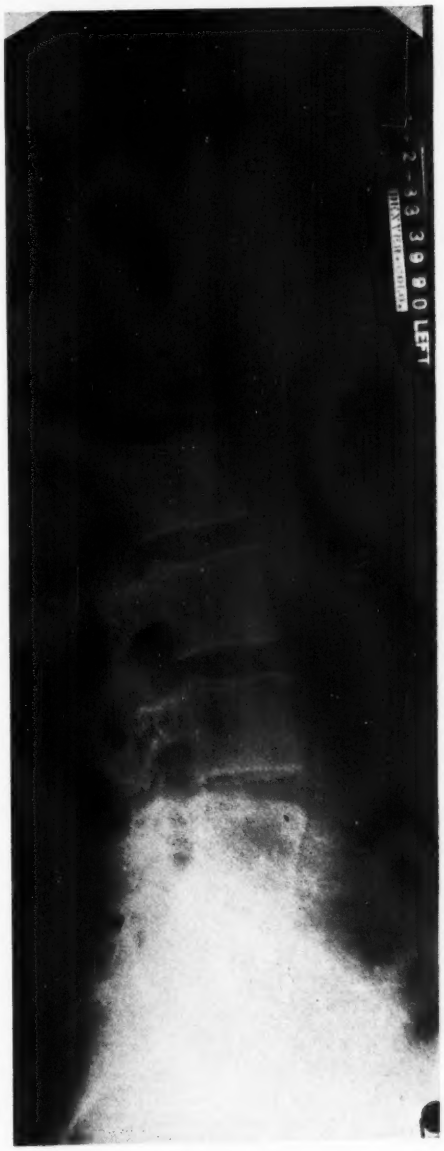

Fig. 1. Routine lateral lumbar spine. The diagnosis was not conclusive for fracture of the second lumbar vertebra.

* Read before the Colorado Society of X-ray Technicians, Nov. 14, 1933.

[1] Radiographs shown in Figures 1 to 6 were made at the Presbyterian Hospital, Denver, Colorado, by technicians Hébert, Buehler, and the author.

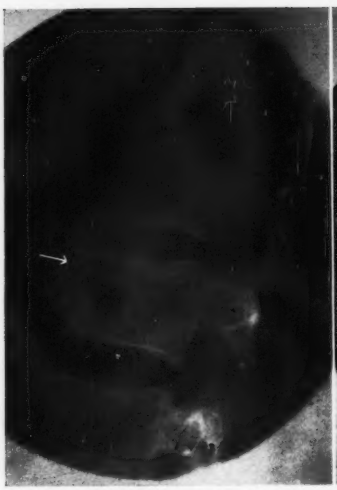

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 2. Same case as shown in Figure 1. Follow-up lateral of second lumbar vertebra. Note increased visualization of detail, resulting from the use of a fine cone. Compare with Figure 1. The line of condensation indicates compression fracture.

Fig. 3. Check on the same case as shown in Figures 1 and 2, five weeks later, reveals satisfactory position and some callus formation. Callus would hardly be visible without the definition caused by a small cone.

Fig. 4. Follow-up anteroposterior of case shown above, made with a dental cone. Compare with Figure 5, and note the increase in clarity of bone architecture.

Fig. 5. Routine anteroposterior view of case shown in Figure 4. Compare the detail of these two radiographs.

obviously inaccurate. Now that high milliampere-seconds and low kilovoltage are used in radiography to produce maximum contrast, repeated examinations which fail to visualize the proper vertebra must be kept at a minimum because of the effect on the skin.

The method to be described determines accurately the amount of distortion present; it requires a chart which can be made easily by the x-ray technician (Fig. 6). The numbers on the chart are empirical. The base-line, A, represents the lateral profile of a cassette 17 inches long. The numbers on line D represent the distance in inches from the cassette toward the x-ray tube. A chart of convenient size is made by electing the scale "one-half inch equals one inch." The position of the x-ray tube is represented by T, and a line straight down from the tube, D, corresponds with the central ray; this line bisects the base-line, A, at X. B indicates the surface of the Bucky diaphragm. The empirical units on the base-line denote the distances from this point (X) toward the edges of the cassette. The lines Y and Z represent movable strings

used to indicate oblique rays from the x-ray tube. In making the chart, attach the strings to line D at the number representing the target-plate distance used on the anteroposterior spine plate.

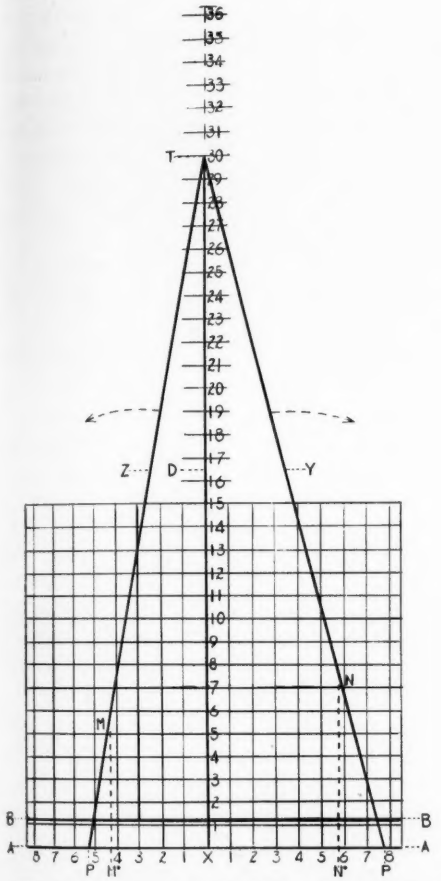

Fig. 6. Chart for computing distortion. Numbers are empirical units. (A) lateral profile of plate; (D) distance from cassette toward tube; (T) x-ray tube; (Y and Z) movable strings; (B) surface of the Bucky; ($M'N'$) actual size of object; (PP) size of the x-ray image.

This chart furnishes a method of precision for a common radiographic practice. It is merely a diagram of the practice of using a yardstick or an imaginary line along which to sight from the tube to the cassette through a desired body landmark, to assure its visualization at a given location on the film (Fig. 7).

Throughout this explanation of the procedure of using the chart, visualize the patient as lying supine on the Bucky diaphragm as when centered for an anteroposterior view of the spine (Fig. 7).

At the time the first anteroposterior radiograph is made, measure and record the perpendicular distance from the patient's pubic symphysis to the cassette. This is a landmark rarely covered by a cast.

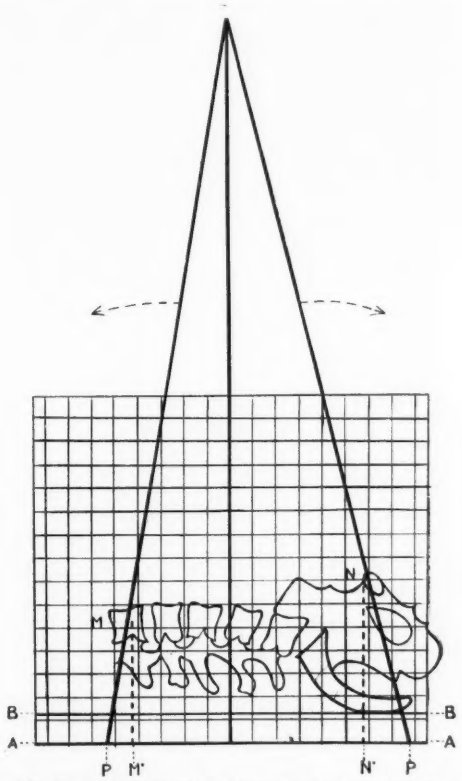

Fig. 7. This illustrates the same chart as shown in Figure 6, with the spine drawn in to show how objects are distorted when the Bucky diaphragm, which increases object-plate distance, is used. (A) lateral profile of plate; (B) surface of Bucky; ($M'N'$) actual size of object; (PP) size of the x-ray image.

If a check examination is ordered, place the anteroposterior film made at the first examination on a view box, and mark on the spine a point equidistant from the upper and lower edges of the film. Figure 8 shows this point marked X; it corresponds with X on the chart (Fig. 6). Now

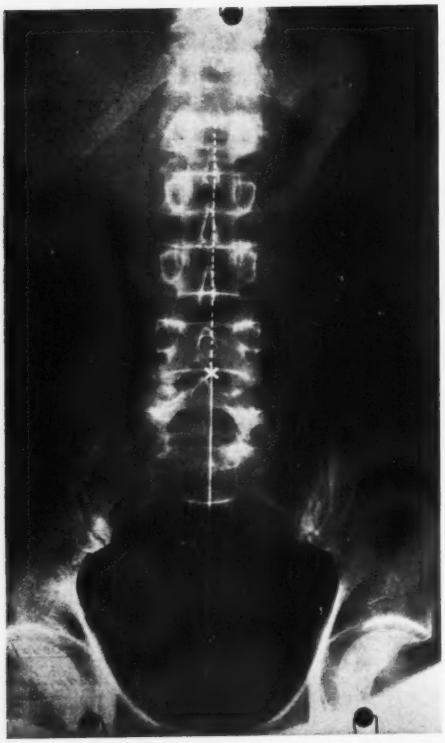

Fig. 8. Anteroposterior view, showing measurements to be transferred to the base-line of the chart (Fig. 6).

measure on the plate the distance from this point to the pubic symphysis, which in this case was seven and three-fourths inches. (In this example, the first lumbar vertebra is to be x-rayed.) Now using the chart, move string (represented by line Y, Figure 6) to the empirical number of the base-line which designates the distance in inches (seven and three-fourths) that the top of the pubic symphysis was below X on the anteroposterior *plate* (Fig. 8). Now locate on line D the *actual* distance (measured and recorded at the time of the first examination) from the pubic symphysis to the cassette (seven and one-fourth inches). Fasten a thumb tack on the chart where the string crosses this level. (See N, Figures 6 and 7.) This represents the location of the pubic symphysis at the time of the first anteroposterior radiograph.

On the anteroposterior plate previously used, now measure the distance from the center of the body of the desired vertebra to point X (the first lumbar was five and one-fourth inches). Again using the chart, move string, Z, along the base-line five and one-fourth units from the center on the opposite side of X, from which string Y was placed. Just as it is necessary to know the distance from the symphysis to the cassette to determine point N, it is necessary to know the distance from the designated vertebra to the cassette when the patient is supine to determine point M. The former was measured on the *patient*. For the latter measurement the original lateral *view* may be utilized. Place this plate crosswise

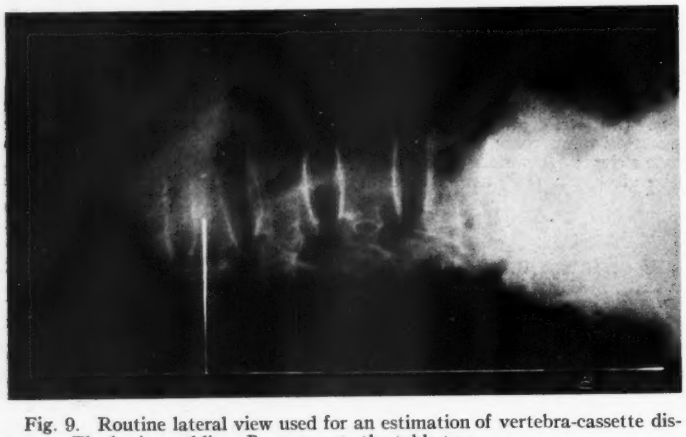

Fig. 9. Routine lateral view used for an estimation of vertebra-cassette distance. The horizontal line, *B*, represents the table top.

on a view box with the spinous processes down. Draw a line on the film at the posterior edge (inferior aspect when the film is

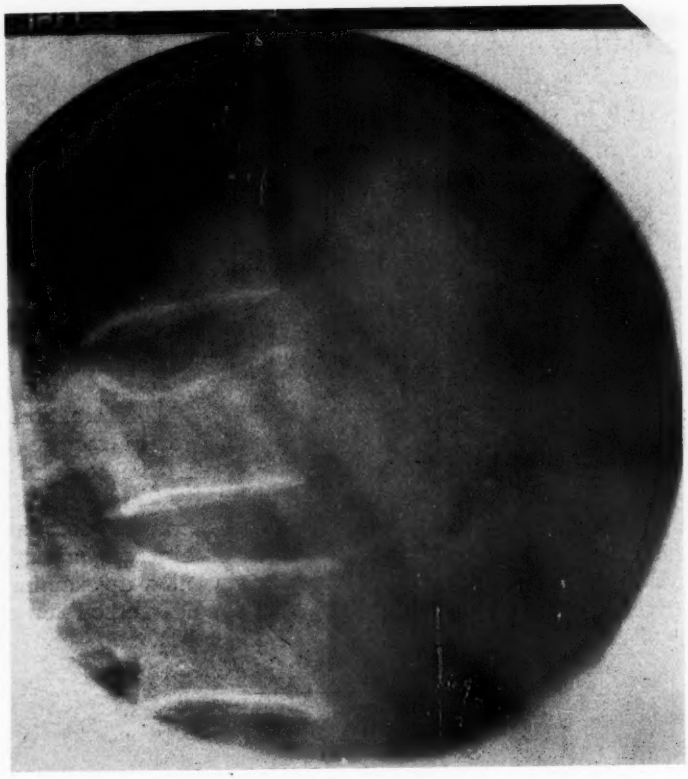

Fig. 10. Check through cast with fine cone, illustrating a result obtained by the use of the method described in the text.

crosswise) of visibility of the soft tissues, which is virtually the plane of the table top. This view, therefore, is the equivalent to the lateral profile of the patient while lying on a table in the supine posture. Measure the distance of the center of the body of the designated vertebra from the Bucky table. (See Figure 9; B represents the surface of the Bucky.) To this distance add the distance from the top of the Bucky table to the cassette.[2] In this example, four inches plus one and one-fourth inches equal five and one-fourth inches.[3] Transfer this sum to the chart on line D. Fasten a thumb tack on the chart where the string crosses this level. (See M, Figures 6 and 7.) This represents the position of the vertebra on the chart.

The next procedure is to drop a perpendicular from M and N to the base-line, and establish points M' and N' on the base-line. N' is five and three-fourths inches from X since the numbers empirically represent inches; accordingly M is four and one-fourth inches from X. Five and three-fourths inches plus four and one-fourth inches equal ten inches. This is the *actual* distance on the patient from the pubic

[2] If this is not known, it can be obtained from the manufacturers of the Bucky diaphragm, and of course will be constant in all cases x-rayed on the same table.

[3] The error caused by distortion in this short measurement is not significant.

symphysis to the point on the longitudinal axis of the patient, at which to center to depict the involved vertebra. The centering point along the horizontal (crosswise) axis is selected in the routine manner. Note that on the anteroposterior *film* this distance is 13 inches. Thus, the distortion in this case is three inches. The chart automatically computes and allows for this distortion.

When a vertebra in the thoracic spine is designated, the intraclavicular notch may be used as a landmark instead of the pubic symphysis. If plates of the lower dorsal and upper lumbar spine are requested, and neither of these landmarks appear on the film, place a small marker on the patient's abdomen a known distance (recorded for future reference) from the pubic symphysis. This can be used as a landmark for chart calculations. At the time of the check examination, again make use of the pubic symphysis for determining the centering point on the patient, by merely adding the formerly recorded distance from the landmark to the pubic symphysis.

This method without modification may be used in cases of moderate scoliosis. Cassettes 7 by 17 inches are becoming popular. When one of these is used for the lateral view, center at a point to assure visualization of the spinous processes. Any error caused by lateral stereoscopy is insignificant and may be ignored.

Though the description of this method may seem complicated at first reading, once used it proves to be simple and practical. It will be noted that it requires only four measurements from a routine examination transferred to a chart. Figure 10 illustrates a radiographic result of the practical use of this method. The radiograph was made through a heavy body cast and the desired vertebral body is almost exactly centered.

SUMMARY

1. Follow-up examinations of a single fractured vertebra require the use of a small cone and are being more frequently requested.

2. The literature does not present a method for centering a single designated vertebra in follow-up examinations.

3. A simple method for accomplishing this is described.

ROENTGEN ASPECTS OF SYMPATHETIC NEUROBLASTOMA

WITH REPORT OF TWO CASES

By ADOLPH HARTUNG, M.D., *and* SAMUEL R. RUBERT, M.D., *Chicago*[1]

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REPORTS of tumors arising in various locations from the cells of the sympathetic nervous system, with variations in terms and classifications, have appeared in the literature from time to time since Wright (1), in 1910, first recognized the neurogenic nature of these neoplasms and applied the term neuroblastoma to them. They are also commonly referred to as sympathetico-blastoma and neurocytoma. Two different tumor types have been described. Those cases limited to the abdomen with metastases to the liver from an original site in the adrenal have been called the Pepper type. The cases presenting diffuse metastases to the skull, orbit, and long bones, and not limited to the abdomen, have been called the Hutchison type. Numerous reports subsequent to the original descriptions by Pepper (2) and by Hutchison (3) show such a classification to be without foundation, and that diffuse metastases to the bones and glands may occur in all cases.

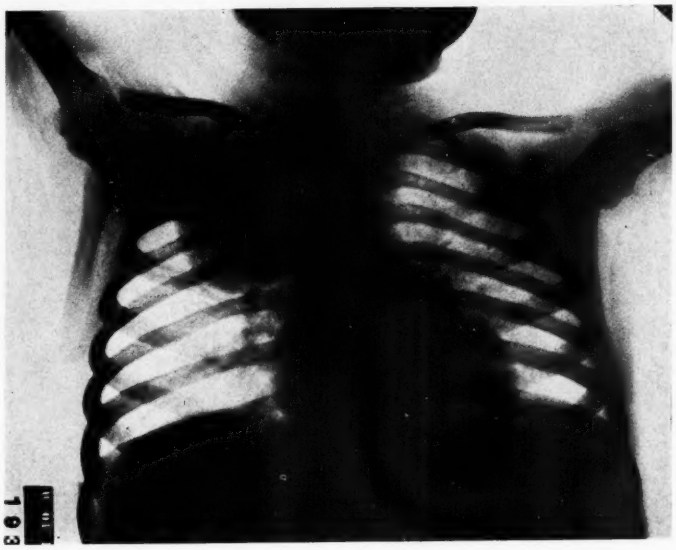

Fig. 1. Case 1. Localized density in right apex representing neurocytoma tumor from which metastases originated.

This paper is presented to add two cases of sympathetic neuroblastoma of cervical sympathetic origin to the literature. The roentgen data associated with them were of particular interest from both the diagnostic and therapeutic viewpoints, justifying a detailed discussion of the findings.

Sympathetic neuroblastomas are found most commonly in infants and young chil-

[1] We wish to express our appreciation to Dr. Julius H. Hess and Dr. H. G. Poncher for the pediatric courtesy in allowing the report of these cases from their service at the Research and Educational Hospital of the University of Illinois.

Fig. 2. Case 1. Blurred orbital outline on left side and diastasis of sutures.

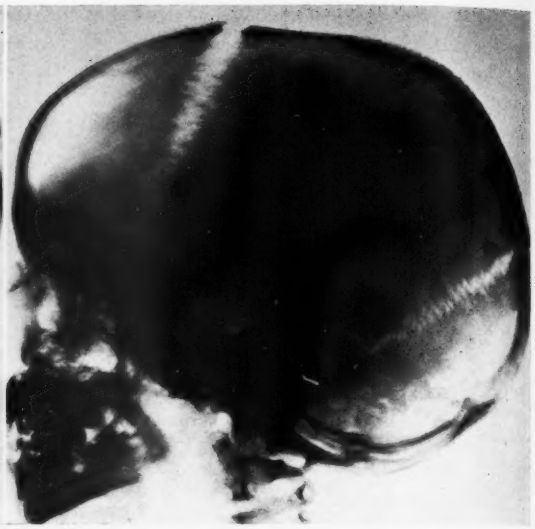

Fig. 3. Case 1. Sawtooth-like indentations of outer table of skull; marked separation of sutures and increased digital markings.

Fig. 4. Case 1. Elevation of periosteum, with new bone formation along shafts. Irregular decalcification of lower end of both shafts and upper end of left shaft.

dren but also appear in adults, and occur with about equal frequency in both sexes.

Increased recognition of these tumors in various locations has shown that they may arise from the cells of the sympathetic nervous system without special predilection for site. Scott, Oliver, and Oliver (4) tabulate a total of 162 reported cases arising in the medulla of the adrenal glands. Scott and Palmer (5) suggest a classification based on descriptive names, following the lines of embryologic development, and tabulate the reported cases arising from the sympathetic trunk exclusive of those arising within the medulla of the adrenal glands. The cervical sympathetic trunk is given as the original site of the tumor in but four of the 37 cases that are listed by them. The others have their origin in various parts such as the abdominal sympathetic, thoracic sympathetic, coccygeal gland, celiac ganglion, mesentery, jejunum, liver, uterus, cavity of the nose, skin, paravertebral region, spinal canal (extradural), and the scapular region.

The gross appearance of the tumor varies somewhat with the location, and presents itself as a soft hemorrhagic mass. The cut surface has a white or gray appearance, with necrosis and localized hemorrhagic areas. When it occurs in the adrenals there

is destruction of the medulla with involvement of the cortex. Secondary metastatic nodules resembling the original tumor appear in the regional lymph glands, liver, and other tissues, including the bones.

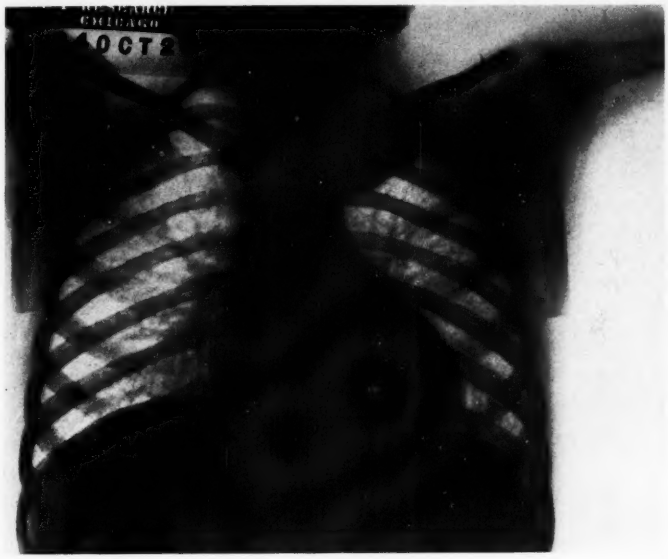

Fig. 5. Case 2. Circumscribed density in left apex representing original tumor.

Microscopically, the tumor is highly cellular, presenting a fibrillar matrix with the cells usually forming rosettes about bundles of fibrillæ. The characteristic cell resembles the primitive migratory cell of the sympathetic nervous system.

The earliest symptoms are usually those resulting from the metastases to the skull and orbit; nodular swellings occur, with progressive proptosis of the eye and surrounding discoloration. Similar nodules may also be present in other parts, such as the cervical region and axilla. A palpable abdominal tumor may be present; pain in the bones and joints also occurs.

The roentgen examination may give valuable aid in arriving at a diagnosis. Holmes and Dresser (6), Henle (7), Lederer (8), and Sturtevant and Kelly (9) have included descriptions of such findings in connection with cases reported by them. In exceptional cases, the primary lesion may be demonstrated roentgenographically as a tumor mass, as in the cases to be reported by us. Usually the findings are limited to changes occurring in connection with the metastases involving the bones. In the long bones these manifest themselves as elevations of the periosteum, due to metastatic tumor infiltrations underneath it along the shaft, or tumor cell infiltrations in the bone. Involvement of the skull seems to be especially common, presenting sawtooth-like defects on the outer table probably due to similar metastatic deposits. There may also be invasion or erosion from adjacent lesions in the soft tissues. Diastasis of the sutures and increased digital markings on the inner table may occur, suggestive of increased intracranial pressure, without demonstrable intracranial or meningeal metastases.

The clinical course is rapidly down hill, with the presenting symptoms becoming more pronounced and progressively worse, with fatal termination.

Fig. 6. Case 2. Marked widening of sutures, with enlargement of skull and irregular mottled decalcification.

The clinical manifestations together with the roentgen findings justify a presumptive diagnosis of the condition, but the ultimate diagnosis usually rests upon biopsy confirmation. Differential diagnosis is largely a matter of exclusion, depending on the site of the original lesion, stage of development, and location and extent of the metastases at the time the case comes under observation. The progressive nature of the condition, course, lack of characteristic laboratory findings, and complexity of reaction serve to differentiate it in most instances from diseases with which it might be confused in certain stages of its development, such as rheumatic fever, leukemia, or even sinusitis.

The roentgen findings associated with bone involvement may be simulated by a variety of conditions from which they may have to be differentiated. Christian-Schüller's disease is characterized by sharply circumscribed multiple defects of the bone, most commonly limited to the skull, but which may involve the long bones, with no associated periosteal reaction or elevation, and without evidences of increased intracranial pressure. When involvement of the bones occurs in Niemann-Pick's and Gaucher's diseases, the findings are limited to infiltrations into the substance of the long bones. These diseases are characterized also by an associated spleno-hepatomegaly and characteristic blood findings. In erythroblastic anemia, sawtooth-like indentations of the outer table of the skull may simulate those of neurocytoma, but other bone changes are usually absent, and a characteristic blood picture is present. Cortical and diffuse subperiosteal infiltrations with periosteal elevation may occur in the leukemias, but the associated blood picture readily discloses the nature of the lesion. A positive serum reaction and the presence of osteochondritis usually identify syphilis. Scurvy presents subperiosteal hemorrhage, with possible displacement of the epiphyses without cortical involvement. In chloroma, the findings about the orbit and skull may be confusing, and differentiation depends on the greenish discoloration that occurs in these cases. Where involvement of the long bones occurs, there is no associated periosteal reaction. Sarcoma and endothelioma may give confusing skull findings, but these are isolated single lesions. In cases in which intracranial neoplasms result in marked diastasis of the sutures, and possible bone erosion, the accompanying neurologic findings usually serve to differentiate them.

Therapeutic measures used have generally been found to be of little avail. Hauser (10) calls attention to the radiosensitivity of the tumor, and reports satisfactory results with regression of the lesion treated. Boyd (11), Kwartin and Twiss (12), and Holmes and Dresser report disappointing results from roentgen therapy, which is similar to our experience.

CASE REPORTS

Case 1. P. W., a female, five years of age, entered the hospital on July 13, 1933, with a history of traumatic injury to the left eye six and one-half weeks prior to ad-

mission, followed by progressive swelling, discoloration, and bulging of the eye. Except for occasional fainting spells, the past history revealed no information pertinent to the existing condition.

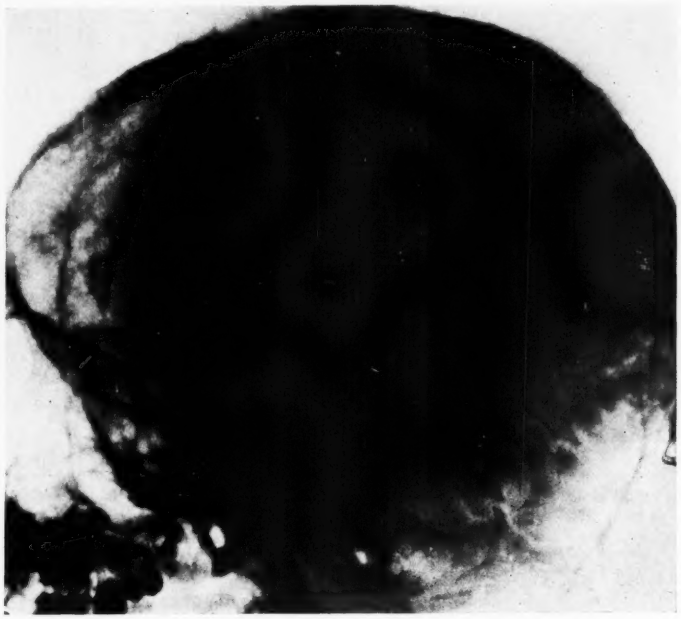

Fig. 7. Case 2. Ray-like calcareous deposits projecting from outer table of skull, with irregular mottled decalcification and marked widening of sutures.

Physical examination revealed a poorly nourished and somewhat underdeveloped child, not acutely ill, who appeared to be quite comfortable and alert. Pallor of the skin and mucous membranes, and flabbiness of the muscles were present. There was also marked proptosis of the left eye, with purplish discoloration of the eyelid, and edema of the conjunctiva. The left pupil was larger than the right, and was sluggish in its reaction to light and accommodation. A firm round tumor mass was present in the right occipito-parietal region, with a few glands in the cervical region. No definite lung findings were present. Percussion and auscultation signs were of a questionable nature, even after the demonstration on roentgenograms of a definite tumor mass in the right apex. The heart was enlarged to the left and a systolic murmur was present. The abdomen presented prominence of the veins, and the liver was palpable one finger beneath the costal margin; spleen and kidney were not palpable. The tendon reflexes were normal and sensation was intact. The fundus examination showed the presence of an optic neuritis.

A provisional diagnosis of neurocytoma was made on the basis of the findings of proptosis and palpable nodules in the skull. The possibilities of sarcoma and chloroma were also considered.

Laboratory findings were as follows: Urinalysis and Mantoux and Kahn tests were negative. Blood examinations upon entrance revealed the presence of a high grade anemia. Subsequent examinations gave no additional findings of positive value.

Roentgen examinations revealed the following: On July 14, films made of the head showed a slight increase in the digital markings of the skull, and well marked separation of the sutures, especially the coronal,

Fig. 8. Case 2. Irregular mottling or moth-eaten appearance of entire shaft of humerus, with pathological fracture of proximal end.

suggestive of increased intracranial pressure. Sawtooth-like indentations of the outer table of the skull were noted. The bones of the extremities, at this time, showed nothing abnormal except cross-striations near the epiphyseal lines, indicative of previous growth disturbances. The abdomen, examined because of a suspected adrenal tumor, showed no pathology.

The chest presented a large well circumscribed tumor mass, replacing the apex of the right lung and extending to the level of the sixth rib posteriorly, with no demonstrable evidence of erosion of the spine or ribs.

On August 2, films made with special reference to the orbits showed a blurring of outline of the left orbit which was interpreted as possibly being due to pressure erosion from the orbital tumor mass. Examination on Aug. 10 of the head and of the chest showed no appreciable changes.

Films made of the femora on Oct. 1, because of pain developing in the thighs, presented an elevation of the periosteum with new bone formation along their entire length. Irregular decalcification of the lower end of both shafts was also present, and of the upper end of the left shaft. These findings were interpreted as being consistent with metastases. The possibility of a sclerosing periostitis of toxic origin was given consideration. The upper extremities also presented slight irregular decalcification and periosteal changes.

During the clinical course the proptosis of the left eye increased markedly, and the eye ball was enucleated for palliation on July 24. The tumor masses present on admission grew progressively larger, and another tumor mass developed in the left temporoparietal region. The cervical glands became more numerous; biopsy of one of them revealed a neurocytoma.

The temperature ranged from 99 to 104, the pulse from 120 to 150, and the respirations from 22 to 40. Anemia, cachexia, and weakness became progressively more pronounced, and death occurred Oct. 31, 1933, five months following the onset of symptoms.

Administration of deep roentgen therapy, giving 550 r units over the tumor mass in the chest (July 28 and Aug. 2), effected no definite changes in the size of the tumor or course of the disease.

The clinical diagnosis (confirmed by biopsy) was neurocytoma (sympathetic neuroblastoma), originating in the optic nerve and metastasizing to the chest, bones, and brain or meninges.

The autopsy findings (abstracted from report made by Dr. George Milles) were as follows: The head presented a protruding tumor mass, measuring about 8 × 10 cm., in the region of the left orbit and extending into the frontal and parietal regions. The orbit was distorted and the bulb was absent. A swelling, measuring about 9 × 7 cm., was present over the vertex, and irregular matted nodules up to 5 cm. in size were present in the cervical region.

Moderate congestion and edema of the lungs were present, and there were parenchymatous changes in the heart, kidneys, and liver. The adrenals, gastro-intestinal tract, spleen, and uterus gave no pertinent

findings. There was involvement of the peri-aortitic and cervical lymph nodes, and the ovaries and liver were largely involved and replaced by tumor cells.

The lungs lay free in the pleural cavity, and a fluctuant tumor mass about 5 × 6 × 3.5 cm. was present behind the pleura in the region of the right apex. One of the right cervical roots extended into it and the sympathetic chain could be partially traced behind it. The cut surface of the tumor revealed a firm gray border area around a rather sharply circumscribed cavity filled with a gummous gray material.

The ribs presented numerous tumor infiltrations immediately beneath the periosteum near the vertebral ends and at the costchondral junctions. Similar subperiosteal metastases were present along the shafts of the femora and also in the skull, where they formed infiltrating nodules of variable size continuous with the tumor masses noted at the vertex and in the left orbit. Metastatic nodules were also present along the lateral borders of the bodies of the lumbar vertebræ.

The calvarium was studded with pale gray to dark red nodules of rubbery consistency, which caused a roughening of the bone beneath them, but no erosion. The dura in the occipital region was displaced by a tumor which extended through the skull but did not involve the dura. The convolutions in the brain were flattened, suggestive of increased intracranial pressure.

Microscopic sections of the intrathoracic tumor showed it to contain an irregular fibrous stroma within which rounded cells, moderately variable in size, were clustered in rosette arrangement about the smaller blood vessels, and irregularly distributed in the interestices of the stroma. These cells contained a small amount of granular cytoplasm, with pink staining and poorly defined cell margins, and fibrillar projections extending from a stellate base. The nuclei were rounded or slightly irregular in outline. The chromatin formed a rather dense band about the margin and was distributed through the nucleus in irregular reticular, and in some instances granular, arrangement, allowing vacuolar spaces between. Nucleoli, deeply stained and small, were present in most of the cells. Some mitotic figures were present. In many areas the tumor tissue was broken down, with the formation of a fibrinous granular débris containing some nuclear remains. Similar findings were noted in the metastases examined.

The pathologic diagnosis was a primary neurocytoma, arising about the region of the sixth cervical root, with widespread metastases.

Case 2. S. G., a female, five years of age, entered the hospital on Oct. 17, 1934, with a history of transient pain in various joints over a period of two months, not associated with fever or edema, and resistant to medication. Two weeks prior to admission, the patient suddenly developed a progressive swelling over the right orbit, with proptosis of the eye. Past history gave no other information pertinent to the existing condition.

Physical examination revealed a pale, irritable, well nourished child, not acutely ill. A fluctuant tumor mass was present over the right orbit which was not tender and appeared to be fixed to the underlying bone; the skin was not adherent over it. Proptosis of the eye was present, without discoloration of the lid and surrounding tissue, and edema of the conjunctiva. A small palpable tumor mass was also present in the right postauricular region, and glands were palpable in the cervical region and in both axillæ. The chest, abdomen, and extremities presented no positive findings.

In view of the experience with the preceding case, a provisional diagnosis of neurocytoma was made on the basis of the presence of supra-orbital swelling, multiple palpable glands, and roentgen findings. Biopsy of one of the glands of the axilla confirmed the diagnosis.

Laboratory findings were as follows: Urinalysis and Mantoux and Kahn tests were negative. The blood showed the presence of a high grade anemia.

Roentgen examinations revealed the fol-

lowing: On Oct. 18, films made of the skull showed slight separation of the coronal suture, suggesting increased intracranial pressure. The chest showed the presence of a circumscribed density overlying and replacing the apex of the left lung.

On Oct. 31, films of the long bones showed no demonstrable pathology, and the skull showed no progression of the findings noted on the previous examination.

On Dec. 14, films of the skull showed marked widening of all the sutures, and apparent enlargement of the entire skull. Irregular mottled decalcification was present. These findings were even more pronounced on films made Jan. 15, 1935, and ray-like calcareous deposits were seen projecting from the outer table of the skull, with irregularity of bone contour in the frontal region, and an apparent bone defect at the vertex.

Definite findings in the long bones were first demonstrated on films made on Dec. 31. Irregular decalcification of the bone was present in the distal ends of the shafts of both femora. The right humerus showed periosteal elevation along the distal portion of the shaft. On Jan. 16, 1935, the findings in the femora were more marked, especially on the right side. The left humerus showed similar findings in the proximal end, and the right humerus showed a marked irregular mottling or a moth-eaten appearance along the entire shaft, with the presence of periosteal elevation. A pathological fracture of the upper end of this bone was also present at this time.

The findings in the chest remained approximately unchanged during this period.

During the clinical course the metastases present on admission grew progressively larger and new nodules appeared. Transfusions given for the anemia produced no effect, and death occurred on Jan. 25, 1935, five months following the onset of the symptoms.

Deep roentgen therapy consisting of 2,800 r units in fractional doses (200 r units daily) over the tumor mass in the chest, produced no demonstrable changes. Administration of 1,200 r units to the supra-orbital tumor also had no apparent effect.

The clinical diagnosis was neurocytoma originating in the cervical sympathetic region, with diffuse metastases.

Autopsy findings were essentially the same as in the first case, and confirmed the antemortem diagnosis.

COMMENT

The cases presented exemplify the high degree of malignancy of sympathetic neuroblastoma as shown by the rapid progress with diffuse mestastases, and serve to call attention to the difficulty encountered in attempting to localize the primary site of the lesion *antemortem*. They are unique in that the roentgen examinations revealed the original tumor located in the lower cervical region, presenting itself in the chest and replacing the apex of the lung. In addition, they showed marked metastatic bone changes which were fairly characteristic. They demonstrate that a provisional diagnosis can be made on the basis of the presenting symptoms, usually those of the metastases, and consisting of supra-orbital swelling, proptosis of the eye, and roentgen findings.

SUMMARY

Two cases of sympathetic neuroblastoma of cervical sympathetic origin are reported in detail, with special reference to the roentgen findings. These consisted of a tumor mass in the chest, which represented the primary lesion in both cases, together with multiple metastatic lesions in the skull and long bones. Roentgen therapy applied in both cases failed to affect the tumors appreciably, and produced no apparent change in the course of the disease.

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THE FUNNY BONES OF THE HUMAN HEAD, VIEWED IN THE LIGHT OF THE CO(S)MIC RAY[1]

By HONORABLE HARVEY T. HARRISON, *Little Rock, Arkansas*

I AM indeed grateful to my friend and your distinguished fellow-member, Dr. Rhinehart, for the complimentary introduction he gave me. Perhaps I'd be impressed by it more than I am except for the fact that on numerous occasions I have tried in vain to convince twelve good men and true that Dr. Rhinehart is worthy of belief. But notwithstanding that fact, I still am ready to maintain that he is one of the finest expert witnesses that money can buy.

Notwithstanding the complimentary words which have been spoken concerning me by Dr. Rhinehart—words which, had they been spoken of anyone else would have sounded almost like flattery—I am going to assume a democratic attitude toward you this evening. I am going to talk to you and treat you just as if you were my equals. I want everybody to feel perfectly at ease in my presence this evening, even the ladies. Don't suffer yourselves to be embarrassed or in the least intimidated by this arrogant and supercilious air which I carry around with me. After all, this manner of mine is not a real presentation of my inner attitude. I can't help looking this way. You see, by nature, I have a proud and a haughty bearing. That is because I belong to the ruling class in this country. I am a debtor. Thanks to the New Deal, the ancient Scriptural maxim that the borrower is servant to the lender has been reversed; now it is just the other way 'round.

This happy topsy-turvydom is the outcome, I suspect, of the present-day mood for political experimenting—a mood which proceeds on the assumption that the old order changeth, yielding place to new, and God fulfills himself in many ways lest one good custom should corrupt the world.

There was once an old American custom that made it respectable for a fellow to pay his debts. We are now operating under a new American custom that regards it as old-fashioned for a fellow to pay his respects.

But there is one old custom which doesn't seem to change, one old custom which time cannot wither. That is the custom of trying to cure all our social and economic distempers by the enactment of laws—salvation by statute. Whenever our money gives out, our legislatures give in. When times are hard, legislation is easy.

Legislative panaceas change very little from age to age; that is, they change very little in substance. They always operate on the principle that when Fortune ceases to smile on the prodigal, legislation should frown on the frugal; that the best way to liquidate the liabilities of the improvident is to soak the prosperous; that economic recovery is best brought about by that method which substitutes for the system that every tub should stand on its own bottom a system whereby most of the tubs stand on a few bottoms.

So in our American system, whenever we are in economic doubt or in doubt about any other of our problems, our method is to sit down and write to our Congressman. Whether our troubles be sociological, biological, or economic, every son of affliction among us rises up to declare that there ought to be a law; both here in the great State of Tennessee, where you have enjoyed such fine hospitality from a very pure strain of the sons of men, and over in my own State of Arkansas, where we lifted the frowning barrier of a municipal statute across the path of natural law in the belief that by so doing we'd stop the trend of evolution dead in its tracks.

[1] Humorous speech delivered at the banquet of the Radiological Society of North America, at Memphis, Tenn., Dec. 6, 1934.

Yes, and we have spread a barbed wire entanglement of "thou-shalt-nots" about the human nature of our neighbor in the fond belief that thereby we could curb his natural depravity, purify his morals, and convert his conscience to such an extent that he'd never get past the ban of our prohibitions until he should sprout wings and fly over—to that blessed country where the righteous cease from troubling and the wicked are at rest.

And everywhere, throughout this broad American land of ours, we have taken the tide of speculation at its flood in the last few years and have gone on an economic joy-ride on a barge of promissory notes, and when the flood goes out and the barge comes down and the notes fall due, once more we will stretch forth the pontifical hand of legislation and, like Joshua of old, command time to stand still, bid the sun to pause in his career over Gibeon, and the moon to hang motionless above the vale of Ajalon, until we get ready to pay our debts.

And then dear old Uncle Sam—God bless his benevolent old hide—arrays himself in his Santa Claus suit and goes jingling through the land, scattering sugar in every direction, and behind him comes the tax collector gathering where Santa has not scattered. That is where you and I come in: that is where we do our part and win our Blue Eagle, and when we get through doing our part we may be even bluer than the eagle for there is nothing that escapes the tax collector.

We are supposed to be the tax collector's sugar bowl and no bowl is so small or so scantily supplied with sugar to be beneath the tax collector's notice or to escape his scoop. Not even a lawyer's purse! Or, to shift my metaphor, we are the black sheep of the flock and up and down the land rings the nursery refrain,

> "Baa! Baa! Black sheep,
> Have you any wool?"

and whether we have three bags full or just a little fuzz, it's coming off, and we will be lucky if the hide doesn't go with the hair.

Nothing is so flimsy or so skimpy as to escape the tax collector's shears—not even women's underwear. Yes, sir, the process tax has taken hold of women's underwear for the benefit of the Southern cotton farmer on the theory, I suppose, that when the women took off their petticoats they ruined the South. But I am sure you will agree with me that there is no kind of a tax so wholly un-American in principle as the tax on women's underwear. That is just a flagrant illustration of taxation without representation.

But after all, we shouldn't get so worried about the idea of the tax burden. We have a method already under way that is going to relieve us of the oppressiveness of taxation. We are making our money so cheap that pretty soon it won't be good for anything except to pay taxes and debts.

Then, I don't think we ought to get unduly worried about this big spending spree that the country is going on. All of the money that the Government has been putting out in the interest of economic recovery was borrowed money, which is the easiest money in the world to spend, once a fellow can get hold of it. And, you know, there is not anything in the world that so stimulates enterprise, that so stimulates business activity, nothing that so encourages far-sighted investments by short-sighted investors, as borrowed money.

Just a few years back here in the golden age of the New Era, think what happened! Back there in 1928 and 1929 we saw little businesses start out, expand, become big businesses and spread out and become bigger businesses, spread out and become going concerns—and now they are gone!—all because of borrowed money.

But I wouldn't have you get the idea for anything in the world from anything I have said that I am not a lover of my country. I am really one of its most ardent lovers. Of course, we have our little tiffs now and then, as any lovers will, especially when tax-paying time comes 'round, and

when somebody insists on applying the NRA code to my business, which I think is such a fine thing for my competitor's business.

When I was much younger than I am now, I was exceedingly fond of my country; you might say almost overfond of it. I was so outspoken in my admiration of my country and took on over it so much in public that it is a wonder we didn't get ourselves talked about. At that time it seemed to me to be the very last word in perfection, being, as it was, "the home of the brave and the land of the free," where every citizen was a sovereign, free to worship God as he pleased and bent on making everybody else do the same thing.

But in the course of time the War came on. While I still was a great lover of my country, I saw no reason for acting foolishly and losing my head over it, so I addressed myself to the task of keeping the home fires burning. I can say without any thought of boasting and without any fear of successful contradiction that I maintained one of the hottest home fires that was to be found in my section.

I can remember when the hearts of the citizens of this great republic were quaking in terror at the very suggestion that at almost any time vast argosies of bombing planes were likely to appear above the fair cities of New York, Chicago, and Little Rock, those great centers of our country's population, and discharge those terrible explosives that were popularly supposed to blow a square mile of territory into smithereens in one blow and to scatter typhoid germs from coast to coast.

At that crucial hour I joined up with one of the most terrifying combat units this country has ever known—an organization of gas troops known as the Four Minute Men. Many a night when the call of duty came have I kissed my wife and babe goodbye, snatched up my deadly manuscript, and rushed down to a moving picture show or vaudeville theater, there to be sandwiched in between the lady acrobat and the trained seal, and for four inexorable minutes have held a vast audience at bay while I stiffened my country's *morale* and inspired my countrymen to buy Liberty Bonds until it hurt. Now I have lived to see them hurt!

No man ever served his country in such hazardous labors as this more zealously than I did; no man ever uttered such hard and such mendacious words against his country's foemen as I directed against the Hun. I make this statement not for the purpose of bragging, but I do insist that if a fellow has a war record, he has a right to derive whatever prestige he can from it, and if a fellow has once offered to die for his country, why, he should expect to live off of it the balance of his life.

But I had no sooner got the War off my hands and the taste of calumny off my tongue and the stage all set to make the world safe for democrats, than I awoke to the discovery that a new state of mind had grown up in my country amid the distractions of war—that the clock of moral progress had struck *sex* in America. Well, sirs, that was a liberating discovery and it was attended with some very interesting developments.

The most immediate effect, of course, was to lift polite conversation out of the dull, humdrum levels of respectability and to set it moving in a fresh and adventurous direction—especially fresh. The vocabulary of social commerce took on a strong, gamy, bawdy, Elizabethan flavor, derived from an infusion of new words that up to that time had been shut up in the sly lexicon of unmentionables. For when men and women awoke to the fact that they could talk freely to one another about anything, they wouldn't talk about anything else.

Then all at once new areas of my country's anatomy began to show up, lovely and tempting areas, the existence of which, though long suspected, had never before been publicly acknowledged. Then was there fulfilled before my very eyes the prophecy which the Lord spake in the long ago to his prophet Joel, saying, "In those days your young men shall see visions and your old men shall dream dreams."

It would be pressing the stroke, perhaps, to say that by this time America had come of age, but it is no exaggeration to say that it had arrived at the age of indiscretion.

But coincident with the birth of our new freedom there developed a very irritating and an exceedingly ironical complication. We had no sooner gotten rid of our moral restraints, no sooner had we been divested of our inhibitions and had donned our moral negligee, than we discovered that our liquor had been taken away from us. Of course, that was a very exasperating experience. Just think of it, the irony of that situation! Not an inhibition on the premises, a long-repressed libido that had at last broken jail and was yearning to celebrate, and not a drop to drink!

It was particularly provoking to a typical 100 per cent American of my years and disposition. There I was, without any war on my hands, facing the world with nothing but a pocketful of money made out of war profits—nothing but this money and a rambunctious libido that was looking for an opportunity to get going. As I say, this was a provoking situation in which to find myself, being as I was this type of a person—one who up to that time had been so circumspect in all of his conduct (I mean his public conduct), so regardful of all the proprieties, that to have known me then and to have listened in on my conversation up to that time you would have been justified in suspecting that I was descended from a long line of maiden aunts.

But when they took away my moral restraints and when my liberated libido smote on its chest with a brawny fist and leaped to the driver's seat of my behavior and shouted, "Boy, let's go!" and went speeding to the cupboard for the jug of rum, only to find that the cupboard was bare, I realized then that I was the victim of a very unkind sort of joke.

And so what happened is what you would naturally expect to happen, being what I was—a 100 per cent American. I was at that time made up of one part Puritan, one part reformer, and one part rebel, and when these three parts set up in a fellow's disposition and begin to take notice of one another's presence, you can always look out for a ruction.

But this is not all of the indignities that were heaped on us, for while our attention was distracted by the many things that Volsteadism had heaped upon us and all of the problems that it had thrust up, while all of us pious folks were busy shaking our fists under one another's noses and sputtering and cussing each other in dispute over moral questions, the ultimate indignity was foisted upon us—woman suffrage.

Then we realized that this glorious democracy of ours was going to have to put up with just twice as much of the same thing. Of course, petticoat government was not a new thing in American experience, but up to that time it had been purely a domestic and a private régime. I might say this in our defense—that while we had stoutly for generations held out against the aspirations of mother, wife, and sweetheart to share with us the responsibilities and the prerogatives of the ballot, our opposition had not been due to any lack of affection for our women-folk or any lack of confidence in them. Our opposition was, rather, inspired by fear—the fear that since politics makes strange bedfellows, the converse might be true.

This survey of American history brings us up to that point in our experience where the War-to-end-wars had been tidily tucked away for all time in the closed files of history, and where we had gotten rid of our inhibitions and our taboos, and where the veil of secrecy between the sexes had disappeared so that we were all ready to agree that a woman is just as good as a man. And it brings us up to the time when our behavior was perfectly circumscribed and safely insured against moral transgression by high walls of prohibitory statutes. So we were all ready, all set, to enter upon that new era, that era when poverty was to be abolished—that marvelous golden age that was ushered in under the auspices of the great construction engineer whose adversaries claimed that within four years

he ditched, drained, and dammed the country.

But before surveying that bit of our country's history, I feel I ought to digress to tell you how we people, here in Tennessee and Arkansas, peculiarly prepared ourselves to be worthy of the great riches with which we were going to be invested. Riches bring on responsibility, of course. So in order that we might be pure and a superior race, particularly the people of my State, the State of Arkansas, followed the example that had been previously set by our proud neighbor here, the State of Tennessee.

Back in the general election of 1928 when Alfred Smith was running for President as a nominee on the Democratic ticket, two burning issues confronted the citizens of my State. We were called upon to decide at the polls whether the citizens of Arkansas had descended from monkeys; another question we had to decide was whether we were going to turn into Republicans. And what if we had done so? Wouldn't we feel now that subsequent events had sure enough made monkeys out of us?

But, you know, that is one of the troubles of evolution. You can never tell what it is going to lead to.

Well, both the Republicans and the monkeys were defeated at that election but by such a narrow margin that it left no room to the victors for bragging. However, I am not so much concerned with the political aspects of that great contest. What I want to remind you of is this: Just a little over six years ago I and the other citizens of my great State were in the grip of pitiless biological processes, just as many of you north of the Mason-Dixon line may be to-night. We didn't know what we might become; we only knew what we might be come from.

All that is changed now. We have ordained by popular vote of the people that no one shall teach in a tax-supported school in the State of Arkansas any theory that man is either ascended or descended from a lower order of animals. I hope you will just notice what a beautiful statute that is, how noble in all its parts, how even-handed in its operation. There's nothing discriminating about it at all. It extends to every person within its sway the equal protection of the law, whatever his race, color, or previous condition of servitude.

And there is nothing snobbish about it, either. We haven't stopped at saying that man has not descended from a lower order of animals but we insist that our citizens haven't ascended, either. All we ask is just the privilege of holding our own!

We may not have realized the dream of the Brain Trust and have pegged commodity values at their 1926 level, but over in Arkansas we pegged human nature at its 1928 level. We have joined up with the great State of Tennessee here in the creation of a sort of refuge or preserve where the sons of Adam can continue to propagate their species without any fear of being crossed up by a simian taint.

Then came the dawn of a new era when we were going to abolish poverty and everybody was going to get rich, not in the cumbersome, old-fashioned way of our fathers, through the processes of thrift and industry, but going to get rich quick; when everybody turned sucker and began to lay hold of the lollypop of speculation. Everybody was running around and getting hold of debentures and securities, gold label (or rather gold libel) bonds and all manner of non-par, non-voting, non-paying, nonsense stocks—these things they called *securities* (or rather *mis*called securities).

That was a part of the jargon that Big Business brought into existence at that time. Big Business brought us a new language—big words. Big Business no longer went to see a fellow to talk with him; Big Business "contacted" a man. That is a Big Business term for "touching" him. You no longer sold a fellow a bill of merchandise; you "serviced a customer," which is to say to clean him, and grease him, and put him on the skids.

Big Business prospered through the operation of financial structures. A finan-

cial structure is a structure or an edifice where a group of strong-jawed, quick-deciding, slow-thinking men get together and swap promissory notes with one another and against this security issue all of these beautiful, iridescent *securities*. They call it "floating them," which is a good term for it because, like Ivory soap, they float on water. They made the most iridescent bubbles in the world.

So we saw this great country of ours filled with little grown-up children running about over the lea holding up pink, chubby fingers, reaching after the bright, beautiful iridescent bubbles that had been blown up out of the waters of these securities.

Just five years ago the bubble broke and down came lollypop, sucker, and all. Yes, just five years ago the people of this country woke up one morning to find that they could go out and buy what they wanted for just about one-half or two-thirds of what it would have cost them to buy it the day before, with this exception: they couldn't charge it.

Well, this discovery scared us all nearly to death because for years the typical American had been taking to his heart as a special injunction to himself the last words of Marmion, "Charge, Chester; charge!"

When we discovered that we could no longer obey this beautiful injunction and when we discovered, moreover, that a dollar in the hand was worth two in the bank, it was more than our gumption could cope with. The shock was too great for us. Not knowing what else to do, we fell into a panic and began running around in circles like stampeded cattle and bawling to one another that the country was going to the bow-wows. And, because faith is a creative thing and because people tend to make their beliefs come true whether in the region of hope or in the region of fear, it wasn't long until every mother's son of us began to hear the wolf howling on his doorstep.

When the folks found that they couldn't any longer go out and borrow the money to pay off their debts, then they lost their nerve, the principle on which they had been living. The biggest bunch of optimists the world has ever seen turned pessimists overnight and began running to cover, scuttling to cover like so many crawfish whose response to a challenge is always a retreat.

The trouble about covering is this: that when everybody in the bed takes the same notion at once, the cover comes in for a whole lot of pulling. And since the currency blanket is not charity, which according to the Scriptures "covereth a multitude of sins," but, on the contrary, is short and narrow, the blanket gets torn in the tussle and everybody wakes up with frozen assets.

So it is no wonder that when the old credit cow began to go dry and her tits began to shrink up and to wither and to draw away from the lips of the multitudinous suckers who had been thriving on them, there should have arisen this clamor which to-day is filling the heavens—a clamor for a political technic that will shift the mazuma from the upper classes to the classes who are on their uppers.

This is an old cry. It is as old as human history, for the human story is nothing more than just one long fortune-shifting tug-of-war between the fellows who are down and out and the fellows who are sitting pretty. The old adage that "Uneasy lies the head that wears a crown" might very well be amended to say, "Uneasy rests the seat that is sitting pretty."

But should we get pessimistic or in terror over this? No. Pessimism would do little good, anyway. But let us not despair of the democratic adventure. Never despair of the democratic adventure when it is passing through its periods of fermentation. "Look not thou upon the wine when it is red, when it giveth his color in the cup, when it moveth itself aright." That is not the time to test its quality nor to appraise its vintage. That is the time when it is likely to abound in headaches.

So let us remember always for our encouragement in times like these that the fermenting juices of this new wine of present-day democracy are derived from

grapes grown in the very same vineyards, garnered with the same hopes and aspirations, trod in the very same presses, and processed through the same chemistry as the good old wine which our fathers bought with their treasure and their blood and which is stored in the cellars of our political faith.

CASE REPORTS AND NEW DEVICES

FAMILIAL BONY DYSTROPHY WITH MULTIPLE EXOSTOSES[1]

By H. A. YENIKOMSHIAN, M.D., M.R.C.P. (Lon.), Associate Professor of Medicine, *and* H. K. BLAKE, M.D., Visiting Professor of Radiology

From the Departments of Medicine and Radiology, American University of Beirut, Lebanese Republic (Syria)

We have had the opportunity of making clinical and laboratory studies of members of a Lebanese family, a number of whom show defective bone development, associated with exostoses. The distribution of these changes in two generations as regards sex, as well as the character of the deformity shown in the roentgenograms, added unusual features to this study, and seemed to us of sufficient general interest to warrant reporting.

F. (Case No. 15,978), a baker by occupation, whose photograph is shown in Figure 1, came to us on June 3, 1932, complaining of bony prominences in different parts of his body, which he had had since childhood. We give a summary of the history and examinations of that date.

His past history showed no other illnesses except chicken-pox at the age of seven, and malaria at the age of twelve.

His present history revealed that when he was from three to four years of age, his parents noticed hard bony prominences on the lower parts of his legs. These were painless, not being accompanied by any sign of inflammation, and not preceded by trauma. About two years later, similar growths appeared around the knees and the upper extremities. The latter were accompanied by a slow bowing of the forearms, with concavity toward the ulnar side. He feels quite well, and has no difficulty in locomotion.

The patient is a healthy looking young man of good muscular development, weighing 51.5 kilograms, 159 cm. in height. His head and trunk are not deformed, but his arms and legs show shortening.

The patient's head and neck are negative except for a hard bony prominence about the size of an almond over the lower part of the occipital bone. His teeth are normal. There is no evidence of disease of the thoracic or abdominal viscera.

Extremities: hard masses can be palpated and in several sites are accompanied by visible swellings, corresponding to the exostoses shown in the roentgenograms. The forearms are shortened and bowed, with concavity toward the ulnar side. The legs are also shortened. The big toe on the right is prolonged; the second is very short, and the curvature of the plantar arch is increased. The reflexes are normal. There is no muscular atrophy; no sensory disturbances. The external genitalia are normally developed.

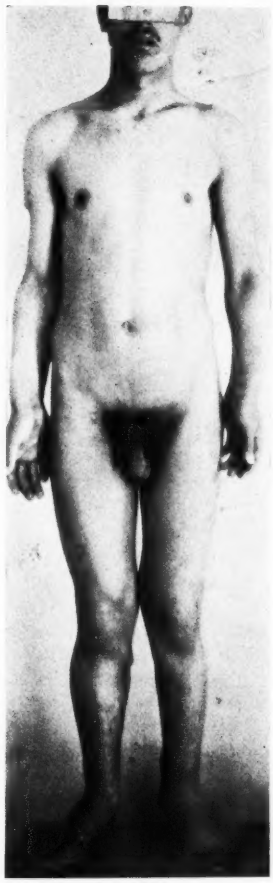

Fig. 1.

The laboratory findings are as follows: blood count and urine examination are negative. The stools show ova of *Tænia saginata*. The blood chemistry showed: plasma phos-

[1] Accepted for publication Jan. 5, 1935.

Fig. 2.

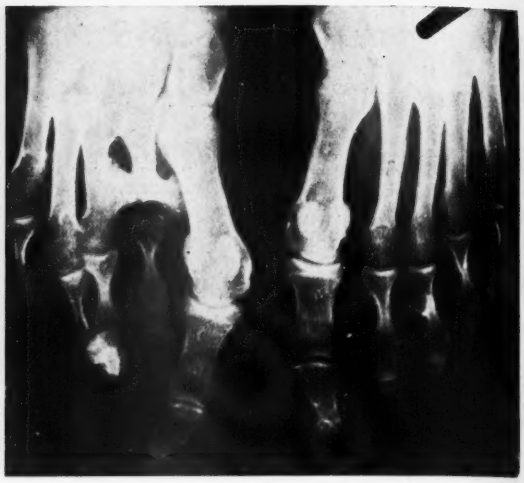

Fig. 3.

phates, 4.99 mgm. per 100 c.c.; chlorides, 596 mgm. per 100 c.c.; serum calcium, 9.97 mgm. per 100 c.c.; blood uric acid, 2.5 mgm. per 100 c.c.

TABLE I.—BLOOD SUGAR AND PHOSPHORUS CURVE

	Sugar	Inorganic phosphorus
Fasting specimen	72 mgm. per 100 c.c.	3.53 mgm. per 100 c.c.
1/2 hr. after 50 gm. of glucose	114 " " " "	3.41 " " " "
1 hr.	87 " " " "	3.46 " " " "
2 hr.	72 " " " "	3.15 " " " "

TABLE II.—FAMILY GENEALOGY[1]

S. (f.)
Age, 35 years; wt., 58.8 k.; ht., 153 cm. Normally developed except for shortening of forearms and legs. Three digits of right foot elongated; the other two shortened. Spurs on both knees. Married twice

First husband (deceased; reported not to have had any skeletal deformity)

Second husband (healthy)

F. (m.)
Case reported in detail, with marked exostoses

A. (f.)
Age, 18 years; wt., 49.6 k.; ht., 146 cm. Practically the same deformities as her brother

E., infant, 17 days old. Roentgenograms negative

El., boy of 1 year. No deformities. Roentgenograms negative

F., girl of 5 years. No deformity. No roentgenograms

A., boy of 6 years. No deformities. Roentgenograms negative

Z., girl of 9 years; wt., 24.7 k.; ht., 124 cm. Legs and forearms shortened. Spur at lower end of l. femur. Roentgenograms positive

E., girl of 12 years. No deformities

[1] Members showing bony deformity are printed in heavy type. There was no history of deformity in parents, brothers, or sisters of S., mother of our patient.

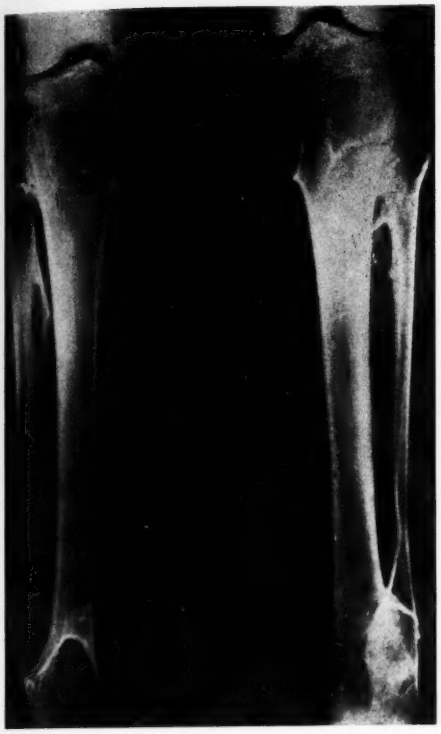

Fig. 4.

The basal metabolism was definitely increased on two occasions, being +27.5 and +32. These figures have added significance as, according to work done by Turner and Aboushadid, the basal metabolic rate of Syrians is normally about −10.[2] In spite of this laboratory evidence, there were no clinical findings of hyperthyroidism.

We have also gone in some detail into the genealogy, and have examined other members of the family. Table II sets forth these data in detail.

The patient's mother shows the same type of exostoses involving her extremities, with similar deformity of her toes. She had married twice, our patient being a son by the first marriage. He had a sister aged 18, who was also affected. By the second marriage there were six living children, ages ranging from 17 days to 12 years. In one of these, a girl of 9, the presence of the typical exostoses was demonstrated by roentgenography. There was no history of bony deformity in the mother's parents, brothers, or sisters. Blood calcium, phosphorus, and cholesterol estimations made in several members of the family were all within normal limits. In all other respects the members of this family were in good physical and mental health.

[2] E. L. Turner and E. Aboushadid: The Basal Metabolism and Vital Capacity of Syrian Women. Am. Jour. Physiol., Feburary, 1930, **92,** 189.

COMMENT

Although we feel the members of this family should be followed carefully in the coming years to detect those who may later develop bony deformities, we have presented a record of these cases to date.

There is no history of syphilis in the family and the Wassermann reactions are all negative. The bony changes do not suggest an inflammatory or neoplastic origin. We have here an hereditary disease which is transmitted by the mother to her children, born of two marriages. Although we cannot ascribe these anomalies of growth to any definitely known endocrine disease, we consider a familial dyspituitarism as the most probable cause.

Scarsdale, N. Y.

A SIMPLE METHOD OF MAKING SERIAL FILMS WITH THE POTTER-BUCKY DIAPHRAGM

By W. O. WEISKOTTEN, M.D., *San Diego, California*

For years it has been our custom to make serial films of certain portions of the gastro-intestinal tract for the purpose of proving or ruling out suspected pathology demonstrated with the fluoroscope. Prior to the time the Potter-Bucky diaphragm came into use, some sort of a more or less complicated and expensive apparatus was necessary in order to properly localize the part under observation, and to provide a means of holding and shifting the cassette used in making these serial films.

All of the various types of apparatus sold by manufacturers were designed primarily to be used without the Potter-Bucky diaphragm. Some may be used with a flat Potter-Bucky diaphragm but none of them can be conveniently used with a standard curved top diaphragm. Most roentgenologists are now making their gastro-intestinal films with a fast Potter-Bucky diaphragm, with a fraction of a second exposure, thereby obtaining better films, especially if the patient weighs 150 pounds or more.

The making of single films of the gastro-intestinal tract with the Potter-Bucky diaphragm is of course a simple procedure, but often there is indication for the making of a series of films of the pylorus and duodenum, either curvature of the stomach, the cardiac portion of the stomach, or of certain portions of the small or large intestine when the pa-

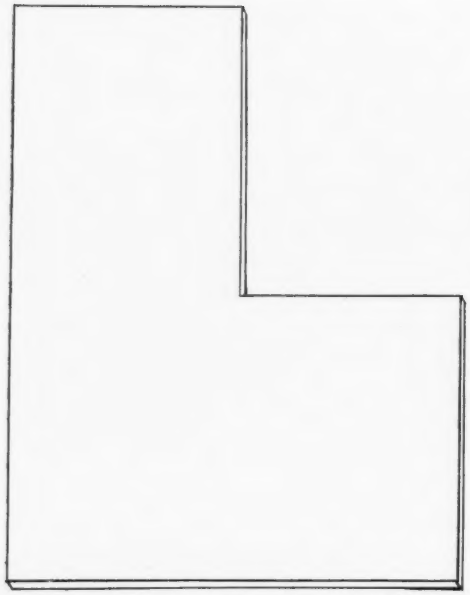

Fig. 1. A diagram representing lead shield reinforced with sheet brass—total thickness three millimeters, made to fit a 11 × 14 cassette; one-quarter cut away for serial exposures.

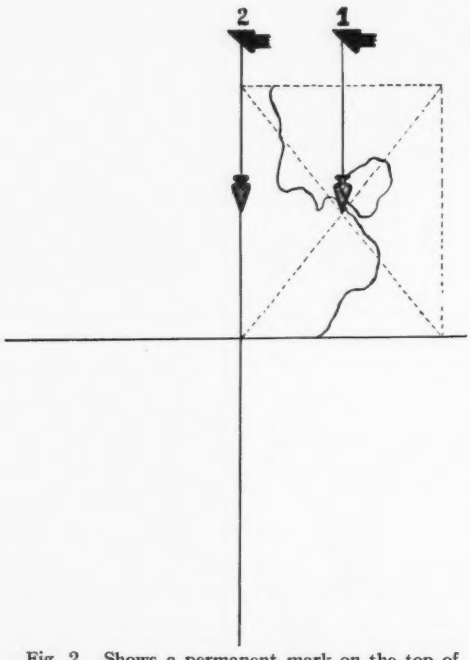

Fig. 2. Shows a permanent mark on the top of the Potter-Bucky, localizing the center of the unprotected portion of the film. Tube position "1" is for localization of the patient; tube position "2" for exposure.

tient's weight really demands the use of the Potter-Bucky diaphragm.

For some time the writer has used, with a great deal of satisfaction, the lead cassette shield here described, and a standard curved top Potter-Bucky diaphragm for making serial films of the gastro-intestinal tract. A flat-top Bucky would work equally well or possibly better if the top of the diaphragm does not sag under the patient's weight. The method is very simple and the cassette shield is inexpensive; the older method of making films without the Bucky has been entirely discarded.

A piece of sheet lead, the exact size of the cassette to be used, is accurately cut, and the edges smoothed and squared. One quarter of this lead shield is carefully cut away, and a thin piece of tempered brass is made to accurately fit the lead shield. Instead of fastening the brass sheet and the lead together with small rivets, the edges are "sweated" or soldered together, and later smoothed with a file and emery cloth. This makes a neat-looking shield, free from rivet holes. The brass sheet backing protects the soft lead from bending and renders the whole shield more substantial. The shield with lead and brass is approximately three millimeters thick, and care must be exercised in handling it in order to prevent bending. It must lie absolutely flat on the top of the cassette; if not, the moving grid may interfere with it. If a Victor Bucky diaphragm is used, additional space between the cassette and the grid may be obtained by reversing the cassette tray; one side of the tray is higher than the other. This method may be applied to any Potter-Bucky diaphragm. If there is not sufficient clearance between the top of the cassette and the moving grid, it is a simple matter to construct a tray which will allow an additional three millimeters of space.

With the cassette in the center of the Bucky tray, the lead shield is so placed as to leave the upper right quarter of the film unprotected. A point is permanently marked on the top of the Potter-Bucky diaphragm corresponding to the exact center of the unprotected quarter of the cassette. The tube is now moved laterally, and, by means of a plumb bob, is centered to the permanent mark on the top of the Bucky. A file mark is placed on the horizontal arm of the tube stand which marks the proper location of the tube off center for future use.

The patient is examined in the prone position with the fluoroscope, and that portion of the gastro-intestinal tract under suspicion is marked with a square of adhesive plaster affixed to the skin of the back. The patient is now placed prone on the Potter-Bucky diaphragm, and the square of adhesive plaster is brought in a vertical line with the center of the

tube and the center of the upper right quarter of the cassette. The tube is now moved back to its normal center position over the Bucky. This prevents grid lines, and utilizes all of the available radiation.

The usual fractional second exposure is made; the subsequent serial films are made by shifting the cassette and the lead shield in a manner which will expose each quarter of the film, and protect the remaining quarters.

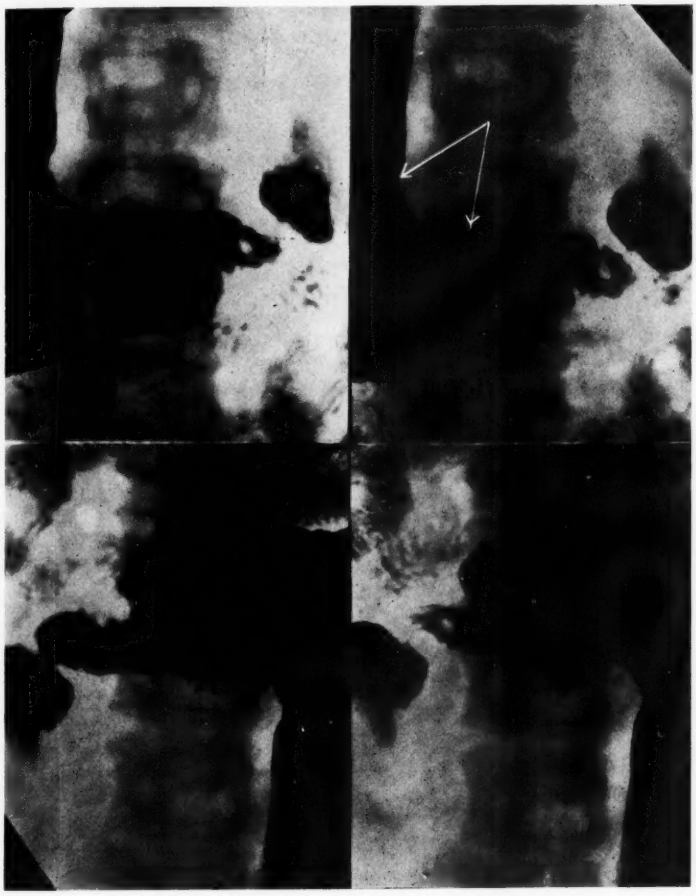

Fig. 3. A typical serial film made with the Potter-Bucky diaphragm.

EPITHELIALIZATION OF CHRONIC OSTEOMYELITIC CAVITIES

A PRE-CANCEROUS LESION

By ALEXANDER BRUNSCHWIG, M.D., *F.A.C.S.*
Chicago

From the Department of Surgery and Division of Roentgenology, University of Chicago Clinics

IN a previous report, three cases of chronic pyogenic osteomyelitis, with draining sinuses of over 50 years' duration, were described, in which the large intramedullary cavities were found to be partially or nearly completely lined by stratified squamous epithelium (1). This was the result of a downgrowth of the cutaneous epithelium along the draining sinuses. An additional case was reported by Milgram (2). Erdheim (3) showed that in an analogous manner epithelialization of small tuberculous cavities in the calvarium may take place.

The following case is recorded because it is another instance of epithelialization of a chronic osteomyelitic cavity, in the manner described

Fig. 1. Chronic osteomyelitis, with cavity formation in the shaft of the tibia, at the site of previously ununited fracture. A chronic sinus draining this cavity was present on the anterior aspect of the leg.

above. Whereas in the other four reported cases the osteomyelitis was present for 50 years or more, in this instance it was of 17 years' duration.

CASE REPORT

P. H. (116,021), white male, aged 65 years, was admitted to the University of Chicago Clinics on Nov. 5, 1934, presenting an oval epithelioma about 2 cm. in diameter on the inner aspect of the left cheek just within the angle of the mouth. This lesion was a recurrence after operative removal 12 years previously.

In 1914, as a result of a fall, the patient sustained a fracture of the mid-portion of the left tibia. Following immobilization, there was non-union, and a bone graft was applied unsuccessfully. The non-union persisted until 1918, when a second operation was performed, at which time the fragments were wired. Following this procedure there was pain and swelling in the leg and high fever, necessitating removal of the wires. The acute symptoms then subsided, but a draining sinus persisted. In 1923, a second bone graft (from the right tibia) was applied, and this was followed by consolidation, and closure of the sinus. There were no symptoms until 1931, when the sinus re-opened spontaneously and the surrounding tissues became swollen and quite tender. This sinus has persisted, but the patient is able to use the extremity with the minimum of discomfort.

The significant findings on physical examination were: (1) the intra-oral lesion described above, the malignant nature of which was confirmed by biopsy; (2) an oval area about 8 × 4 cm. on the anterior aspect of the mid-portion of the left leg, in which the skin is thickened, scaling, and exhibits a dark blue discoloration. In the center of this area was an oval sinus about 1 cm. in diameter and 1.5 cm. deep, leading to the bone. A small fragment of the sinus wall nearest the bone was removed for microscopic examination. Sections show the presence of stratified squamous epithelium.

Roentgenograms of the left tibia showed, at the junction of the upper two-thirds of the shaft with the lower third, an old sclerotic osteomyelitic process several centimeters in length, in the central portion of which was a transverse oval cavity about 2 × 3 centimeters. In the upper portion of the fibula is an old united fracture. The fibular shaft below the fracture is hypertrophied.

Because the patient was suffering the minimum of discomfort from the chronic osteomyelitis, he permitted only a conservative procedure. On Jan. 10, 1935 (operation by Dr. Edmund Andrews), under ether anesthesia, a longitudinal incision was made in each direction from the sinus. Subcutaneous tissue was reflected off the bone with difficulty. The roof of the cavity was chiseled away, exposing its deep wall, which grossly was lined by a grayish membrane. The latter was curetted away as thoroughly as possible and the cavity saucerized. The extremities of the incision were closed by interrupted sutures, and the mid-portion was packed with gauze. A more extensive procedure would have predisposed to refracture at the old site. The intra-oral lesion was later treated by application of radium.

Microscopic examination of the walls of the sinus reveals it to be lined in part by stratified squamous epithelium, which in places extends as thin cords into the underlying dense fibrous tissue. At one point the proliferation is such as to strongly suggest an early squa-

mous-cell carcinoma. Sections of the fragments curetted from the deepest portions of the cavity show stratified squamous epithelium proliferating over sclerotic cancellous bone.

Pathologic Diagnosis.—Partial epithelialization of a subcutaneous sinus draining an osteomyelitic process. Partial epithelialization of chronic osteomyelitic cavity in the tibia.

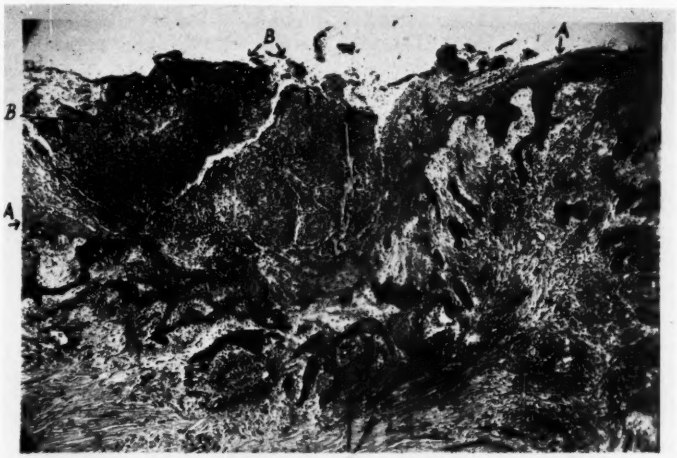

Fig. 2. Photomicrograph (× 60) of section from wall of sinus, draining osteomyelitic cavity in tibia. The sinus is lined by stratified squamous epithelium (*A*); granulation tissue, presumably from non-epithelialized areas, is present over a portion of the epithelial lining (*B*). Elongated cords of epithelial cells (*C*) extend from the lining into the subjacent dense fibrous tissue, in places suggesting early malignant degeneration.

Fig. 3. Photomicrograph (× 63) of section through curettings from deep wall of intramedullary cavity in tibia. Segments of stratified squamous epithelium (*A*), alternating with spicules of bone (*B*), indicate that partial epithelialization of the cavity has occurred, by down-growth of cutaneous epithelium along the draining sinus.

Some bony fragments exhibit no epithelial covering. No calcified marrow is seen (see previous reports).

DISCUSSION

Epithelialization of chronic osteomyelitic cavities, by down-growth of the cutaneous

epithelium along the draining sinuses, is not only of pathologic interest, but is also of clinical importance in that it appears to be a precancerous lesion, as well as a cause for persistent drainage. For, in a study of specimens exhibiting squamous-cell carcinomas arising in conjunction with chronic osteomyelitic sinuses draining cavities within the bone, it is noted that the carcinomas arise *within* the sinus or the bone cavities and extend outward. It would seem that the stimulus to malignant degeneration of the epithelial cells in these localities is twofold: first, their continued proliferative activity in attempting to completely line the sinuses and cavities, and, second, the constant irritation to which they are exposed as a result of the chronic inflammation in the surrounding tissues.

In the presence of ostomyelitic cavities, with draining sinuses of many years' duration, biopsies of the tissue deep within the cavities should be performed when possible. If stratified squamous epithelium is present, the likelihood of eradicating the process by local operation is remote. Most surgeons are now agreed that in elderly patients presenting extensive chronic osteomyelitis amputation is justified when symptoms are severe. In such cases in which epithelialization of the bone cavities is present, amputation will also remove a potentially malignant lesion.

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COMPARISON OF DIFFERENT TECHNICS IN PROTRACTED EXTERNAL IRRADIATION[1]

By MILTON FRIEDMAN, M.D., *New York City*

This exhibit represents a three-years' study of the principles and practice of protracted external irradiation in the treatment of mouth and throat neoplasms. As a result of this, we have been able to elaborate fundamental principles pertaining to that technic with some degree of certainty.

In the beginning, we attempted to reproduce Coutard's exact technic, administering 200 r units (with back-scattering) through two portals, one treatment in the morning and one in the afternoon. The factors were 200 K.V.; 4 ma.; 60 cm. distance, 2 mm. Cu and 1 mm. Al filter; 10 × 15 cm. portal. This produced an epithelitis that commenced on the thirteenth day, and terminated on the thirty-ninth day, and an epidermitis that commenced on the seventeenth day and terminated on the forty-fourth day. In other words, the two reactions overlapped. Both reactions reached a second degree intensity and were accompanied by superficial denudation of the skin.

After having standardized this technic, we used the 5-gram radium pack filtered through 6 mm. of lead and administered it in such daily doses as to reproduce similar biological burns of the skin and mucosa. The portal measured 8 × 10 cm., and the radium-skin distance 6 centimeters.

This we have done in 125 cases over a period of about three years and as yet have found little or no superiority in the radium over the x-rays. This astonished us greatly, since it was contrary to our former working hypothesis and contrary to the experience of most other workers.

We are unable to explain the fact that this ray of very short wave length, greater penetrability, and presumably greater potential energy from the radium pack is not very superior to the x-rays.

We were able to establish another principle with reference to interstitial radiation. During the course of the administration of these daily treatments of divided doses, if the tumor has shrunken approximately 50 per cent at the end of from fourteen to sixteen days, it will probably disappear completely as a result of the external radiation alone. If the neoplasm has not yet shrunk 50 per cent in from fourteen to sixteen days, it will become necessary to institute interstitial radiation.

If this interstitial radiation is given after the reaction has subsided, which would be about six weeks after the first treatment, the fibrosis produced during the process of repair will have altered the character of the tumor, rendering it much more radioresistant. Also, as a result of the extensive external radiation, the tumor bed will not be able to tolerate the amount of interstitial radiation we would like to give. Consequently, if we find that our external radiation has failed in completely eradicating the tumor and we must give interstitial radiation, we have a much more difficult problem to handle, namely, a tumor which is more radioresistant and a tumor bed which cannot tolerate the amount of interstitial radiation necessary.

Therefore we have adopted this working hypothesis: at the end of from fourteen to six-

[1] Presented before the Radiological Society of North America, at Memphis, Tenn., Dec. 3–7, 1934.

teen days, we take stock. If the neoplasm is responding and has reached 50 per cent of its original size, the external radiation is continued. If it has not yet reached that size, all external radiation is terminated then and there in order not to modify the tumor bed too much, and in order not to have the tumor itself rendered more radioresistant by increasing the desmoplasia.

We give our interstitial radiation immediately, though the patient may be suffering with a very acute reaction—his skin peeled off, the mucosa of his entire oropharynx and aural cavity inflamed. At this time only a small amount of additional interstitial radiation is required to supplement the external radiation.

If we wait a longer time, the effect of the external irradiation will have worn off. Nature repaired its damage with fibrosis, and we must consider the residual lesion an entirely new tumor to be treated.

Another principle that we have found concerns the amount of filtration to be used with the x-rays. We have tried giving the x-rays with 2 millimeters of copper filter and have also treated a series of cases using 0.5 millimeter of copper filter. In both cases we have administered radiation at the same rate, *i.e.*, 200 r to one area in the morning and 200 r to the other area in the afternoon. The patients are treated every day except Sunday. When 0.5 millimeter of copper was employed, we noticed, at the end of two weeks, at which time a little more than half the dose had been given, that the reactions came on and were very acute, so much so that we usually terminated the external radiation shortly thereafter, when only about 2,400 r to each portal had been given.

One would assume that, coincidental to this acute destruction of the skin and mucosa, there would be an equivalent effect upon the tumor; however, that is not the case, because the tumor is not modified as much as when a larger total dose is given. When a 2-millimeter copper filter is used, the full total dose of from 4,000 to 4,200 r units can be given to each of the two portals, making a total of from 8,000 to 8,400 r units.

Consequently, we advocate the use of a 2-millimeter copper filter in protracted external irradiation whenever possible. If some concession must be made to economic necessity, we suggest the curtailment of the distance factor, using only 50 or 40 cm. distance, together with an increase in the milliamperage. Coutard always employs a 2-millimeter copper filter. He is not compelled to make economic concessions.

The final problem studied was the daily time factor, best studied through the medium of the radium pack. A 5-gram pack was used, as mentioned above. The patient was treated for one hour each day, giving 5,000 milligram-hours to one side of the neck on one day, and 5,000 to the other side on the succeeding day, averaging 2,500 milligram-hours a day to each portal. Then we set up two small 100-milligram packs, one strapped to each side of the neck, leaving them in place continuously so that irradiation was emitted for twenty-four hours a day.

In summarizing the results, we find that it requires only four-fifths of the amount of radiation with the small pack as was required with the large pack, given over the same period of time and producing the same results. In other words, 43,000 milligram-hours delivered to one portal with a small pack will produce the same degree of epithelitis and epidermitis, coming on at the same time, as is produced by 55,000 milligram-hours with a large pack.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor* HOWARD P. DOUB, M.D., *Associate Editor*

PROPOSED SICKNESS INSURANCE[1]

The development of the science of radiology has been phenomenal. Less than forty years ago the x-ray was discovered. It is doubtful if there has ever been such progress in any branch of medicine through all of its history up to the present time as you men present at this meeting have developed in the past ten years.

It is most unusual for a science to develop so rapidly that a pioneer in its development may receive the plaudits of the world for his success while still active in his profession. Usually his value is not recognized until long after his days of usefulness are gone.

This progress has been made possible by you men of vision. There has never been a greater revolution of ideas and ideals than has been exemplified by your tenacious and everlasting spirit of resourcefulness.

You have created for yourselves an enviable position. Your usefulness is indispensable. The surgeons, internists, and those practising other branches of medicine fully recognize and duly appreciate your invaluable consultations. We no longer send patients to you for x-ray films; we send them for your opinion. Your diagnostic skill is an aid to every branch of medicine. You have evolved from x-ray mechanics to radiologic consultants.

You are in constant contact with the other members of the medical profession on questions of diagnosis and treatment of many diseases. This contact gives you a great opportunity to broaden your field of usefulness. For this reason, if I may digress to the common interest of the whole medical profession of the United States, I would solicit your attention and support for our common good.

Your progress has shown how diligently you have striven along scientific lines. That ability *to do* prompts me to direct your attention to matters for the good of all. I want you as missionaries among the profession.

To-day we are confronted with an extraordinary situation of the utmost importance to the health and welfare of the people of the United States and to the medical profession, namely, enforced sickness insurance. Philanthropists, social workers, economists, and various foundations are apparently endeavoring to exploit the medical profession and assume control. This question will probably be presented to Congress soon, also to the legislatures of many States. The bills are drawn and the movement already has acquired much momentum.

You can have some influence individually but the American Medical Association is the only organization qualified to speak and act for the varying interests and ideas of the profession as a whole. Its official family has been earnestly and strenuously at work for months on this problem.

The American Medical Association has an abundance of information available to you. They urge in the *Bulletin* that you acquaint yourselves with the situation and give them your support. They do not believe it possible to defeat this legislation but they hope for the best compromise possible. The most encouraging item I have seen for a reasonable law came from the meeting of the National Conference on Economic Security. To quote a paragraph from President Roosevelt's address at this meeting:

> "There is also the problem of economic loss due to sickness—a very serious matter for many families with and without incomes and therefore an unfair burden upon the medical profession. Whether we come to this form of insurance soon or later on, I am confident that we can devise a system which will enhance and not hinder the remarkable progress which has been made and is being made in the practice of the profession of medicine and surgery in the United States."

At this same meeting, Secretary of Labor Miss Perkins said:

[1] Presented before the Radiological Society of North America, at the Twentieth Annual Meeting, at Memphis, Tenn., Dec. 3–7, 1934.

"Our problem is to bring adequate medical care within the reach of those who cannot at present afford it. To this end the co-operation of the medical profession is vital, and I have every confidence that such co-operation will be accorded by the profession which has always had such fine traditions of public service."

In closing, I hope you will not think I have taken undue advantage of my opportunity to appear before a scientific body of this character and force upon you a topic of economics. However, this issue is approaching. Every one present is more or less involved. Sickness insurance has been tried in many countries; in no country has it been suggested or promoted by those supposed to reap the benefits from its operation.

In 1880, Bismarck, in Germany, introduced it for political purposes. In 1911, Lloyd George, in England, proposed it purely for political purposes. In no country has it improved the practice of medicine or the medical profession. Make yourselves thoroughly familiar with the various phases of sickness insurance.

I know it has always been distasteful to physicians to delve into these matters, but are you going to sit idly by and let the American Association for Social Security or one of a dozen other organizations pass legislation shackling your individual control of your own business? Do you prefer State-paid, high-salaried commissioners dictating to a low-salaried physician how he should render inadequate medical service (which it will be) to the lower income group who have not even asked for it?

Gentlemen, this problem is worthy of your most earnest consideration.

W. L. WILLIAMSON, M.D.

ANNOUNCEMENT

PAN-AMERICAN MEDICAL ASSOCIATION'S CRUISE FOR 1935

CHANGES IN PLANS

Please note important change in ship, time of sailing, and shortening of Pan-American Medical Association Cruise, made necessary by the fact that the steamship *Columbia*, which had been chartered, has been discontinued from cruise service. The Officers of the Pan-American Medical Association have succeeded in chartering the *Queen of Bermuda*, a most luxuriously equipped ship which has a private bath in every cabin. This, of itself, is a much desired convenience which will be appreciated by every traveling member. Another advantage, in the opinion of many of us, is that the sailing date has been advanced to June 29, from New York, on to Rio de Janiero *via* the West Indies, returning August 1. Practically the same itinerary that was contemplated in the original cruise will be carried out.

ALBERT SOILAND, M.D.
Member Governor of Cruise

COMMUNICATION

MINNESOTA RADIOLOGICAL SOCIETY

The winter meeting of the Minnesota Radiological Society was held in St. Paul, Minn., on March 16, 1935. The following program was presented:

1. Radiography of Sphenoid Sinuses through the Open Mouth.
   Edward Schons, M.D., St. Paul.
2. Roentgenological Study of the Mastoid, with Operative Findings in 230 Cases.
   H. M. Berg, M.D., Bismarck, N. D.
3. Biliary Dyskinesia.
   Herman Wolff, M.D., St. Paul.
4. Comparative Value of Radium and Roentgen Therapy in Various Types of Malignancy.
   Charles Drake, M.D., Minneapolis.
5. Roentgen Diagnostic Round Table.
6. Disadvantages of X-ray Paper from the Physical Standpoint.
   Alfred B. Greene, B.Sc., Oak Terrace, Minn.
7. Medical Economics in Relation to Radiology. Informal Discussion

The annual meeting of the Minnesota Radiological Society will be held in Minneapolis in connection with the meeting of the Minnesota State Medical Association, June 24, 1935. At that time the Carman Lecture in Radiology will be given at the meeting of the Minnesota State Medical Association by Dr. Percy Brown, of Boston. Dr. Brown's subject will be, "Value of Fluoroscopy in Roentgen Diagnosis and Carman's Influence upon It."

BOOK REVIEW

RADIOLOGIC EXPLORATION OF THE MUCOSA OF THE GASTRO-INTESTINAL TRACT. By The Cole Collaborators: LEWIS GREGORY COLE, ROBERT EARL POUND, WILLIAM GREGORY COLE, RUSSELL WRIGHT MORSE, COURTENAY INGLIS HEADLAND, and AMES WILLIAM NASLUND. A volume of 336 pages, 243 illustrations and 18 drawings. Published by Bruce Publishing Company, St. Paul, Minn., 1934. Price: $7.50 (cloth) and $10.00 (three-quarters morocco).

According to the authors, the object of this book is to describe and analyze the fundamental roentgenologic principles on which the diagnosis of various lesions of the gastro-intestinal tract must be based and to correlate the anatomic, pathologic, and roentgenologic findings. It is really an elaborate discussion of the Lewis Gregory Cole method of examination of the gastro-intestinal tract and his ideas of its physiology and pathology.

The first chapter is devoted to an interesting historical review of the development of gastro-intestinal roentgenology, in which the virtues of serial roentgenography are extolled. It is significant that in 1910 the senior author attempted to demonstrate the gastric mucosa by a special technic and subsequently has correlated the information gained by this procedure in selected cases with that obtained by his routine serial method. A pertinent discussion of the advantages and dangers of pressure technic is given. The authors state: "We have yet to find a case in which small films, made with varying degrees of pressure, have caused us to alter the diagnosis as based on serial films of full size made without pressure"; . . . that "pressure interferes, in many instances, with the manner in which a normal or pathologic cap behaves . . . and thus external pressure employed to exaggerate the mucosal pattern becomes a two-edged sword with which, we fear, many will cut their fingers."

In Chapter II the essential anatomic facts concerning the various parts of the gastro-intestinal tract are described in a very complete manner.

In Chapter III are recorded the findings observed roentgenologically in the various regions of the gastro-intestinal tract. According to the authors, the four fundamental findings which form the criteria for exploring the mucosa of the gastro-intestinal tract consist of: (1) The lumen of the tract viewed in profile; (2) special folds of the mucosa viewed on edge; (3) pliability of the mucosa to peristaltic contraction, and (4) the pattern of the mucosal folds or rugæ. The first three are described in detail in this chapter.

Chapter IV is devoted to a very comprehensive and excellent consideration of the fourth fundamental finding, *i.e.*, the pattern of the mucosal folds or rugæ. It is of particular value because of the present interest in this subject.

In Chapter V the authors have correlated and evaluated the four fundamental findings previously considered. The various technical methods are discussed and criticized and the advantages of serial roentgenography emphasized. The authors' satirical derision of fluoroscopy adds a certain amount of punch to this chapter that older roentgenologists may enjoy. Certainly if one were to take this discussion seriously the fluoroscope would join the ranks of the "forgotten man." The summary of the relative value of the fundamental findings is worthy of repetition. "The first finding, alteration in contour, is the foundation on which roentgenologic diagnosis of gastro-intestinal lesions are based. The second finding, mucous membraneous folds, is applicable only in local regions for the diagnosis of small lesions. The third finding, pliability of peristalsis, is a very delicate test. It is applicable only when serial films are made, but it indicates the smallest induration that can be diagnosed, smaller even than can be seen or felt by the surgeon at operation. The fourth finding, mucosal pattern, is now in vogue and some observers are giving so much attention to it that the old reliable first finding is either disregarded or dressed up to look like the fourth."

The last part of the book is concerned with a verbal dissection of and comments on Forssell's article concerning the autoplastic of the gastro-intestinal mucous membrane, concerning which the authors' deductions are almost diametrically opposed to those of Forssell.

The appearance of the book is most timely because of the present interest in "pressure technic" and mucosal relief studies of the gastro-intestinal tract. The material is well arranged and much valuable information is presented. The historical data will interest the experienced roentgenologist and novice, for there is no doubt that the senior author has received insufficient recognition for some of the observations he pioneered, particularly those concerning the duodenal cap.

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THE APPENDIX

The Roentgenologic Diagnosis of Chronic Appendicitis. A. Bejul and L. Holst. Fortschr. a. d. Geb. der Röntgenstr., 1934, **50**, 344–349.

The following conclusions are drawn:

(1) Every normal vermiform appendix can be filled with a contrast medium under suitable technic. Lack of filling must be regarded as a pathognomonic sign of chronic appendicitis.

(2) Incomplete filling of the appendix is of a certain importance for the diagnosis of chronic appendicitis.

(3) Localized tenderness on palpation over the appendix, especially when the appendix itself cannot be filled or but incompletely filled, is to be regarded as pathognomonic for chronic appendicitis.

(4) Limited mobility of the appendix, especially in combination with other symptoms and signs must be regarded as a positive sign of appendicitis.

(5) Changes in the cecum and ileum may be regarded as secondary indirect signs.

(6) Even filling of the appendix without tenderness on pressure speaks for a normal appendix. Changes in form without fixation and without tenderness to pressure are of no significance.

(7) Roentgenologic investigation for appendicitis is of importance and should be employed in every case, as the diagnosis is facilitated and indications for the extent of the operation are determined.

(In reporting the authors' conclusions it is not our intention to subscribe to the statements made without any qualification.—*Abstractor.*)

H. A. JARRE, M.D.

Spontaneous Chronic Appendicitis. Maurice Cerf. Bruxelles Med., Nov. 18, 1934, **15**, 65. (Reprinted by permission from British Med. Jour., March 23, 1935, p. 47 of Epitome of Current Medical Literature.)

The author points out that, while in acute appendicitis the symptoms are markedly local, in the chronic form they are connected with distant organs, any of which may be affected; this renders diagnosis extremely difficult. Gastric and intestinal symptoms most frequently occur, the former being the most common indications of the appendicular condition. Failure of all gastric treatment is strongly indicative of chronic appendicits. Intestinal conditions are frequent concomitants of chronic appendicitis; if pain is the only subjective intestinal symptom an anterior appendicitis is probably present. Hepatic, renal, pulmonary, and cutaneous affections may also accompany chronic appendicitis. Clinical and radiologic signs vary with the site of the organ. In antero-cecal appendicitis, the type especially present in the young, direct radiologic signs are present, but indirect ones are rare, as the perivisceritis is of late appearance. In retro- or latero-cecal forms, which are rather toxic or dyspeptic, few direct, but many indirect, signs are present.

Concerning the prognosis, cure by operation can be expected in antero-cecal forms, but in the other types, though operation eradicates the progressive infection, it does not suppress the painful or toxic symptoms of the perivisceral complication. Hence, a guarded prognosis should be given in cases showing extremely marked indirect signs.

BLOOD DISEASES

Roentgen Therapy of Diseases of the Blood. R. Pape. Wien. klin. Wchnschr., Nov. 30, 1934, **47**, 1459. (Reprinted by permission from British Med. Jour., March 16, 1935, p. 44 of Epitome of Current Medical Literature.)

According to the author, x-radiation must now be regarded as indispensable in treatment of blood diseases, in which its efficacy is due to the special radiosensibility of cells showing special anabolic activity. In polycythaemia the II Medical Clinic in Vienna has for the past two years used the method of Sgalitzer, in which intensive irradiation of the long bones is replaced by general irradiation in small doses (30 r, or up to 90 r in resistant cases) frequently repeated. After five treatments a further blood count must be done, for a diminished leukocyte count calls for a halt: the red cell count sinks after a few treatments and may remain normal for some years. In agranulocytosis similar treatment is sometimes beneficial if given early. In leukemia, Pape still prefers irradiations of the spleen (and possibly liver) to general treatment in myelogenous—and of the lymph glands in lymphatic—leukemia. Treatment must be broken off before the white cell count diminishes to normal, for they subsequently undergo further reduction. Accordingly, persistence of splenomegaly is in itself no indication for continued treatment. Since the vascular walls in leukemic patients are particularly sensitive, extreme care is necessary in dosage of patients exhibiting a hemorrhagic diathesis. Remissions rather than cures are to be expected.

Other conditions in which x-radiations of spleen and/or liver are often beneficial are hemophilia, essential thrombocytopenia, idiopathic metrostaxis, splenomegaly with lipoxanthomatosis, and splenomegaly with hypochromic anemia masking an aleukemia.

BONES (THERAPY)

Two Cases of Congenital Atrophy of Thumb: Reconstruction by Bone Graft. C. Parisel. Le Scalpel, Nov. 10, 1934, **87**, 1591. (Reprinted by permission of British Med. Jour., March 9, 1935, p. 40 of Epitome of Current Medical Literature.)

The author reports two cases of congenital atrophy of the thumb in which reconstruction was attempted by means of a bone graft. The first case occurred in a girl of 5 years, whose right thumb consisted only of a short, thin stump, with two phalanges and a nail at the extremity. The thumb was inert, and there was no metacarpo-carpal articulation. X-rays showed a rudi-

mentary metacarpal, but the part near the carpal bones was missing. Operation consisted of the insertion of a tibial graft in place of the missing metacarpal bone, one of the ends of the graft being incorporated with the rudimentary fragment, and the other end put in contact with the trapezium. The hand was then kept in plaster for a month. After two years the thumb has developed into a strong and useful digit. The second case occurred in a child of 2 years, and a similar operation was carried out. The thumb was small and atrophic, the thenar eminence was not developed, and there did not seem to be any muscles. X-rays showed that the metacarpal bone was absent. The author states that as this is a recent case it is too soon to judge of the result of the operation, but if the graft takes, it is hoped that it will be as satisfactory as in the former case.

BONE DISEASES (DIAGNOSIS)

The Roentgen Symptomatology of Kaschin-Beck's Disease. W. Graziansky. Fortschr. a. d. Geb. der Röntgenstrahlen, 1934, **50,** 367–376.

A follow-up report concerning several cases afflicted with this disease, demonstrating that the pathologic process without any specific diet and merely under the influence of change of location became arrested. Osseous structure showed decided consolidation, with thickening of trabeculation and some sclerosis. No new premature synostoses developed. Bony growth progressed decidedly during the period of observation.

The conclusion is drawn that environmental conditions and not a constitutional deficiency must be considered responsible for this disease. The paper contains excellent illustrations of typical states of the disease and remarks concerning the differentiation from chondrodystrophy and rickets.

H. A. Jarre, M.D.

BURNS AND INJURIES

Successful Treatment of Radiation Injuries of the Skin. Erich Uhlmann and Grethe Schambye. Strahlentherapie, 1935, **52,** 282–298.

The authors treated a number of radiation injuries of the skin by a radium emanation ointment. One gram of the compound contained from 50 to 100 skin erythema units. After a layer 1 mm. thick of the ointment has been spread over the involved area a dressing is applied consisting of some rubberized material and tape. It remains there for eight hours and is then removed. From 30 to 40 treatments may be given at weekly intervals without harm. During the periods between treatments boric acid (2 per cent) bath and ointments are used on the treated areas. Fourteen cases are briefly reported and some photographs of lesions before and after treatment shown. The results were so encouraging that the authors consider radium emanation ointment as the method of choice in treating radiation injuries of the skin.

Ernst A. Pohle, M.D., Ph.D.

CANCER (DIAGNOSIS)

Elapse of Three Years without Recurrence of Cancer Following Lobectomy for Pulmonary Cancer: Successful Termination of Pregnancy during This Free Period. J. Divis. Zentralbl. f. Chir., Sept. 8, 1934, **61,** 2087. (Reprinted with permission from British Med. Jour., Jan. 12, 1935, p. 6 of Epitome of Current Medical Literature.)

The author describes a case in which three years after lobectomy for cancer of the lung the patient appeared free from recurrence and had recently given birth to a healthy child. She was aged 34, and had a four-year history of dry cough and pain in the chest dating from an attack of influenza. The tumor, the size of a goose's egg, lay in the inferior lobe of the right lung, with an extension toward the hilus; microscopically it was a cubo-cylindrical-celled carcinoma of infundibular, not bronchial, origin. Its genesis was probably due to a chronic interstitial pulmonary sclerosis. The operation, done in two stages, the latter under pressure, was followed by hydropneumothorax and a chronic empyema which was closed by a third operation fifteen months later. Radium applications, after lobectomy, were made to the region of operation and to a hard enlarged lymph gland above the right clavicle.

CANCER (THERAPY)

Cured Carcinoma of Nose and Antrum. M. H. Shutes. Laryngoscope, November, 1934, **44,** 924, 925. (Reprinted by permission from British Med. Jour., Feb. 16, 1934, p. 29 of Epitome of Current Medical Literature.)

The author describes a case of an intranasal papillary squamous-celled carcinoma, which was treated by curetting, followed by x-ray therapy and radium. Five years later there was still no return of the carcinoma, so that the result is classifiable as a cure. At the operation the underlying bone was soft, and came away readily. The contents of the antrum were pus, blood, and epithelial masses. The bleeding was sufficiently controlled to permit the use of the desiccating current. The antral walls were thoroughly bombarded until they were dry and crisp. The intranasal mass was transfixed several times for five or six seconds with a needle, and thoroughly coagulated. One month later six high voltage x-ray treatments were directed to the nose and left antrum, totaling 1,350 r units, with 0.5 mm. copper and 1 mm. aluminum filtration. After sloughing had been completed in five days, 500 mg.-hrs. of radium were given to the left nostril, followed by 750 mg.-hrs. to the left antrum. Five months later there was a suspicious area near the alveolar opening, so 1,200 mg.-hrs. of radium were given to the center of the antrum. The area then diminished in size, and disappeared in three months. Reference is made to other successful results lasting for periods of from two to ten years after operation succeeded by x-ray and radium therapy.

Irradiation Treatment of Superficial Malignancies. H. Dabney Kerr. Jour. Iowa St. Med. Soc., March, 1935, **25**, 129–131.

In the treatment of superficial malignancies, including carcinoma of the lip, Kerr thinks irradiation is equally as satisfactory as surgery. He says: "Good surgery is better than inadequate irradiation and certainly poor surgery is not as satisfactory as irradiation in competent hands. . . In a large series of well irradiated cases of superficial malignancy, including small lip lesions, one can expect primary healing in from 85 to 92 per cent of the cases." He emphasizes the importance of biopsy and describes his method of treatment.

G. E. Burch, Jr., M.D.

An Attempt to Imitate Teleradium Therapy with Roentgen Rays. Erik Ebbehoj. Strahlentherapie, 1935, **52**, 338–343.

The author used roentgen rays of 170 K.V., 3 ma., filtered through 1 mm. Pb + 1 mm. Cu + 1 mm. Al (H.V.L.$_{cu}$ = 1.85 mm.) at 10 cm. focal-skin distance, giving 5 r per minute. This was done in an attempt to irradiate malignancies with roentgen rays under conditions similar to those with the radium bomb. The single dose per field amounted to 480 r, which was given about six or seven times, amounting to approximately 4,000 r per field. The results obtained in 30 advanced malignancies were very encouraging.

Ernst A. Pohle, M.D., Ph.D.

The Value of Irradiation in the Treatment of Ovarian Carcinoma. John H. Harris and Franklin L. Payne. Am. Jour. Obstet. and Gynecol., January, 1935, **29**, 88–93.

The authors compare their results following the post-operative treatment of 38 cases of carcinoma of the ovary with 51 patients who were operated upon and received no post-operative irradiation. Their statistical study shows that irradiation is definitely beneficial. However, the results that may be obtained are not predictable. The treatment prolongs life and relieves symptoms, *viz.*, pain, ascites, and tumor formations. The authors discuss their method of treatment.

G. E. Burch, Jr., M.D.

Preliminary Results Obtained by Teleradium Therapy in Carcinoma of the Larynx and Hypopharynx, in Lund, 1931–1933. Lars Edling. Strahlentherapie, 1935, **52**, 206–215.

This is a preliminary report concerning the results obtained during 1931–33 in carcinoma of the larynx and hypopharynx with the use of a radium bomb (1,220 mg.). An isodose chart is appended showing the distribution of the radiant energy. The total dose applied varied from 52–90,000 mg.-hr. for the larynx and 70–100,000 mg.-hr. for the hypopharynx. In a table the author presents a brief analysis of the cases. Of eight cases of cancer of the larynx, five were free from symptoms in December, 1934. Of 10 patients with carcinoma of the hypopharynx, three were still free from symptoms in December, 1934. In view of the small number of patients observed the author refrains from giving a percentage of cure.

Ernst A. Pohle, M.D., Ph.D.

The Combination of Radiation Therapy with Chemotherapy in Carcinoma of the Uterus. Ludvik Havlasek. Strahlentherapie, 1935, **52**, 242–246.

Sixty-seven advanced cases of uterine carcinoma were treated by injections of from 20 to 60 c.c. of Natrium Hyposulfurosum in combination with Se, Cu, or Pb. The latter appeared to be most effective. X-ray therapy was applied with the following technic: From 3 to 5 large areas at 35 cm. F.S.D., from 160 to 180 K.V., 0.5 mm. Zn + 1 mm. Al; from 80 to 90 per cent E.D. per area. This was preceded by radium application, administering from 35 to 50 mcd. filtered through 1.3 mm. brass plus cork and rubber. The results with the combined treatment by irradiation and injection of the above-named substances were very encouraging. Ernst A. Pohle, M.D., Ph.D.

Roentgen Therapy of Carcinoma of the Lip with Short F.S.D. H. Chaoul. Strahlentherapie, 1935, **52**, 221–225.

The author treated carcinoma of the lip with massive doses of roentgen rays, using an F.S.D. of from 3 to 5 centimeters. Technic: From 50 to 60 K.V., 0.2 mm. Cu, small fields of from 4 to 26 sq. cm., from 100 to 200 r per minute, daily dose from 300 to 350 r, total doses from 4,000 to 9,000 r. In 20 unselected cases the absolute cure amounted to 90 per cent during an observation period of from one to three years.

Ernst A. Pohle, M.D., Ph.D.

The Rôle of Radiotherapy in the Problem of Malignancy. E. E. Shepley. Canadian Med. Assn. Jour., March, 1935, **32**, 252–258.

Shepley reviews the subject of radiotherapy in the treatment of malignancy. He discusses the development, more recent advances, and future of radiotherapy. His bibliography, which apparently is very complete, is not published but may be obtained on application.

G. E. Burch, Jr., M.D.

Our Experience with the Fichera Method in Carcinoma Therapy. G. Schulte and W. Lutteken. Strahlentherapie, 1935, **52**, 247–251.

Twenty-two cases of fairly advanced carcinoma were treated with injections of an organic compound developed by Fichera (Italy). The results were quite disappointing. Ernst A. Pohle, M.D., Ph.D.

Purposes and Significance of the Filtration in the Coutard Method. J. Jovin. Strahlentherapie, 1935, **52**, 344–348.

According to the author, theoretical deductions as well as clinical observations prove that heavy filtra-

tion is essential when using the Coutard method of roentgen therapy. He appreciates the fact that the method is very time-consuming, but if the selectivity of the radiation is desired the heavy filter is necessary. He does not believe that a study of the effect of irradiation on the skin is suitable for investigating this problem. In his opinion there must be a definite difference between the reaction of the skin, the mucous membrane, the connective tissue, and perhaps also of the cancer cell.

ERNST A. POHLE, M.D., Ph.D.

CHEST, COLLAPSE THERAPY

Interlobar Pneumothorax. R. Pohl. Röntgenpraxis, January, 1935, **7,** 9–14.

The types of interlobar pneumothorax are divided into three groups. First, the free or open interlobar pneumothorax in which air is in communication with the general pneumothorax; this type may be seen rather frequently when the lung is adherent. The second group is the limited interlobar pneumothorax, in which adhesions between the interlobar pleura cause an unusual shape of the air-pocket in the interlobar fold. The third group is the encapsulated interlobar pneumothorax in which there is no free pneumothorax; the air is encapsulated in the interlobar space only. It has the shape of a lemon or a spindle. Cavities might be hard to differentiate in such cases.

HANS W. HEFKE, M.D.

DOSAGE

The Construction of Small Ionization Chambers without Directional Effect and Their Use in Roentgen Dosimetry. Peter Rosenfeld and Franz Melchart. Strahlentherapie, 1935, **52,** 307–326.

The authors describe condenser chambers of sphere shape which do not show any directional effect. The method of construction developed by them is quite simple. The dependence of the chamber of the wave length was studied by varying tube potential, filter, F.S.D., field size and back-scattering. There was a marked influence of the quality (filter) and of the back-scatter and a definite influence of field size and focal-skin distance. The chamber may be used for determinations of the depth dose on patients. A table with correction factors is given.

ERNST A. POHLE, M.D., Ph.D.

Experimental Investigation of Some Dosage Conditions in the Technic of Roentgen Treatment Used in Sweden. R. Thoræus. Acta Radiologica, 1935, **16,** 169–177.

The dosage of roentgen treatment applied may be re-calculated from the values free in air to the values at the surface. This method was employed before the more perfect ionization chambers were used. It is possible to re-calculate within an accuracy of ±5 per cent.

G. E. BURCH, JR., M.D.

ERYSIPELAS

Roentgen Therapy of Erysipelas. C. Kruchen. Strahlentherapie, 1935, **52,** 252–262.

The author emphasizes the fact that roentgen therapy of erysipelas is successful only if properly given. The exposed field must exceed the area of visible involvement. The quality of radiation should be chosen according to the depth of the involvement. Doses of from 10 to 20 per cent H.E.D. usually suffice. If multiple areas are involved, they should not be treated in one single day but the entire treatment should be distributed over a number of days. The author gained the impression that unless there is a direct local effect the patient will not respond to the treatment. He also draws attention to the fact that an initial increase in temperature may occur after the first exposure.

ERNST A. POHLE, M.D., Ph.D.

ESOPHAGUS (DIAGNOSIS)

Varices of the Esophagus. Gerhard Wachner. Wien. klin. Wchnschr., Nov. 9, 1934, **47,** 1349. (Reprinted by permission from British Med. Jour., Feb. 23, 1935, p. 31 of Epitome of Current Medical Literature.)

The author states that Wolf, in 1928, was the first to demonstrate radiologically and verify at necropsy the presence of varices in the esophagus in a case of portal obstruction. They are due to enlargement of the collateral circulation channels and may cause the most serious bleedings. The most important x-ray signs are (in addition to broadening of the folds at the lower end of the gullet) sinuous light areas which, although inconstant, recur in the same situation, and round, oval, or clover-shaped light areas. Difficulty may be found in diagnosis from sessile carcinomas (which, however, are more localized and are associated with loss of distensibility) and from peri-esophagitis, in which the contour line of the outward-directed pockets is spur-shaped. In only two among 17 cases of hepatic cirrhosis and two of thrombosis of the splenic vein could Wachner detect esophageal varices by x-rays—one of hypertrophic cirrhosis without ascites, the other of atrophic cirrhosis with ascites. It happens not seldom that radiological detection of esophageal varices is the first objective sign of cirrhosis of the liver; but Wachner describes a case of atrophic cirrhosis in which x-ray findings in the gullet were normal three weeks before death from hematemesis due to varices. Their degree of fullness is dependent on the tone of the esophagus, the abdominal pressure, the position of the diaphragm, and the pressure in the systemic circulation.

FOREIGN BODIES

Foreign Bodies in Intestines. Chevalier Jackson and C. L. Jackson. Med. Rec., Sept. 19, 1934, **140,** 285, 286. (Reprinted by permission from Brit. Med. Jour., Jan. 12, 1935, p. 6 of Epitome of Current Medical Literature.)

The authors describe a method of determining

whether or not to operate in a case of a foreign body in the intestines. They state that so long as it is moving the patient is relatively safe, but if it remains in one spot for four or five days there are grave risks of obstruction or perforation. Daily x-ray examinations are useful when applicable, but in the case of bodies which are not thus shown an examination for tenderness on palpation is most helpful, since, if it is present, the abdomen should be opened at once. Complications are most frequent in the case of pins, needles, bones, and relatively long foreign bodies, such as hairpins, in the duodenal turns of children; ulceration is likely to occur. No cathartics should be given, because the increased contractions of the intestine and the greater fluidity of the intestinal contents hinder the passage of the foreign body, and intensify the risk of damage to the wall of the gut. No change should be made in the diet, but no bulky or stringy food should be given, since it will set up indigestion and increase peristalsis. As a prophylactic all foreign bodies discovered in the stomach should be removed from thence at once by gastroscopy. With the performance of the daily x-ray examination (lateral as well as anteroposterior films) or abdominal palpation should go the careful routine examination of the stools.

The authors state that of 68 patients with recent foreign bodies in their intestines, four died and 64 recovered. Seven developed abdominal symptoms. The foreign body was found to be moving forwards in 55 in this series, but in 13 it became fixed. Of these 13 cases, nine recovered; the four who died already had peritonitis when admitted to the hospital.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

Tumors of Small Intestine. T. M. Joyce. Ann. Surg., November, 1934, **100,** 949–959. (Reprinted by permission from British Med. Jour., March 16, 1935, p. 44 of Epitome of Current Medical Literature.)

The author suggests that tumors of the small intestine are not so rare as is commonly supposed. Relatively few of the tumors are diagnosed before operation or necropsy, owing to the vague and indefinite symptoms which they cause. The majority of small intestinal carcinomas occur in or about the ampulla of Vater, whilst the jejunum holds second place in order of frequency. The ileum shows the lowest incidence of carcinoma and the highest of tumors of the lymphoblastoma group, the latter being extremely malignant. The majority of benign tumors consist of adenomas, and these occur most frequently in the ileum. They may vary from the size of a pea to that of a walnut, and may undergo malignant change. Small intestinal multiple polyps are also found in the small bowel, and of all benign tumors in this region are the most prone to become malignant.

The symptoms of tumors of the small intestine are mainly due to the obstruction caused by the growth, and this is usually only partial and intermittent. Intussusception occurs in about 30 per cent of small intestinal tumors, and is far more frequent with benign tumors than with malignant. Hemorrhage is an important sign, and occurs in nearly all cases, although it may be so slight as to be unnoticed by the patient. Pain varies with the locality of the tumor, but is most often felt in the epigastrium or in the umbilical region. It is usually griping, and may be intermittent or constant. The presence of a palpable mass is the most important physical sign, and in cases of early malignant and benign tumors there is a characteristic mobility. The x-ray is the greatest aid to diagnosis.

Four cases of benign tumors are reported, and these were successfully treated by operation. Of five cases of malignant growth, three patients recovered following operation, one died ten days after, and in the fifth case operation was refused.

The Radiological Aspect of Right Upper Abdominal Pain. L. J. Carter. Canadian Med. Assn. Jour., March, 1935, **32,** 296–298.

In right upper abdominal pain, radiology occupies a significant place. It is employed in the diagnosis of duodenal ulcer, duodenal bands and adhesions, pyloric stenosis, gall-bladder disease, liver function, pyelography, and visualization of the reticulo-endothelial system with the use of thorium dioxide preparations. Certain precautions are cited, as, for instance, a barium meal should not be administered in acute intestinal obstruction, gastric and intestinal perforation, etc.

G. E. Burch, Jr., M.D.

GASTRO-INTESTINAL TRACT (THERAPY)

Intestinal Invagination in Children. L. Osteragard Christensen. Ugesk. f. Læger, Nov. 15, 1934, **96,** 1229. (Reprinted by permission from British Med. Jour., March 9, 1935, p. 39 of Current Medical Literature.)

The author discusses the comparative merits of the conservative and operative treatment of intussusception in the light of earlier publications and of his own material, which consists of 54 cases treated in his hospital since 1922. Of the 52 children responsible for these 54 cases as many as 34 were boys. The cases were classified according as they presented one or more of the four cardinal signs: colic, vomiting, hemorrhage, and a palpable swelling. Colic was absent only in one case, vomiting only in three; but hemorrhage per rectum did not occur in 17 cases. Among the 32 patients under the age of one year, there were only two without such hemorrhage, whereas only seven of the 22 above the age of one year bled per rectum. In 30 cases a swelling was felt on the right side, and in 18 on the left side or in the epigastrium. The correct diagnosis was made before admission to hospital in 44 cases. In 34 of these 44 cases, the correct diagnosis was not, however, made until blood had been passed per rectum.

With the exception of two cases in which bloodless reposition was attempted, according to Monrad's system, the treatment was operative. The mortality was 16.6 per cent (nine deaths), and during the last five

years of the period under review only one of 25 cases terminated fatally.

Even under x-ray control there are serious handicaps to bloodless reposition; and though the author considers that such treatment may be legitimate in the first year of life when the intussusception is recent and the general condition is very unsatisfactory, he states that medical opinion at the present time favors operative treatment in principle.

Intestinal Invagination in Children. Jacob Nordentoft. Ugesk. f. Læger, Nov. 29, 1934, **96,** 1311. (Reprinted by permission from British Med. Jour., March 9, 1935, p. 40 of Epitome of Current Medical Literature.)

The author considers that there is a growing favor for the treatment of intussusception by a barium enema under x-ray control. By 1929 he had succeeded in reducing the intussusception by this measure in three out of five cases, one of which terminated fatally. By 1930 his cases had risen to 10, still with only the one death. By 1933 his cases had risen to 20, still with only the one death. Sixteen other children admitted to the hospital for intussusception presented no definitely palpable tumor, and as no reliable x-ray record was taken, they could not be claimed as evidence of the success of this treatment, although in many of these cases, all of which terminated in recovery, the diagnosis was assuredly as correct as the treatment was beneficial. Up to date, and after the exclusion of the above 16 children, the author has treated 25 definite cases of intussusception in which, with eight exceptions, an enema under x-ray control restored conditions to normal. The eight exceptions were subsequently operated on, and among them occurred the above-mentioned death.

Turning to the position in France, the author states that most French surgeons give the barium enema under x-ray control a chance before attempting an operation. They require that the enema be given by a surgeon under conditions permitting accurate radioscopic control, with every preparation made in advance for an operation should the enema fail.

GENITO-URINARY TRACT (THERAPY)

Uterosalpingography by Interrupted Fractional Injections: A Modified and Improved Technic. Mortimer N. Hyams. Surg., Gynec. and Obst., February, 1935, **60,** 224–228.

The author presents a new method of fractional uterosalpingography, which he believes has distinct diagnostic advantages over the accepted methods. One important advantage is that this new method is attended with little or no pain, whereas in the accepted method severe abdominal cramps are often noted.

The preliminary preparation consists of cleansing of the lower bowel by a mild laxative the night before the examination and a soap-suds enema the next morning. The bladder is emptied and the vulva and vagina are scrubbed with tincture of green soap and water, followed by a pitcher douche of oxycyanide of mercury 1:2,000 at a temperature of 110 degrees F.

After a bivalve speculum fitted with the Hyams diagnostic light carrier is placed in the vagina, the cervix and cervical canal are swabbed with a 3.5 per cent solution of tincture of iodine. A tenaculum is then placed on the anterior or posterior lip of the uterus and a sterile uterine sound is introduced into the uterine cavity to determine the length and position of the canal. The author has devised a flexible tip cannula to replace the usual rigid one. This cannula, which is fitted with a syringe and the usual rubber acorn, is inserted into the uterine cavity until the shoulder of the rubber acorn fits snugly into the external os. With the apparatus in place, a preliminary injection of a small amount of air is then made to determine whether or not there is leakage around the acorn. The syringe is then filled with 10 c.c. of warmed lipiodol and attached to the cannula, which is inserted into the uterine cavity. Five separate injections of 2 c.c. of the opaque medium are made, with an interval between injections for x-ray exposure and immediate development of the films. The instrument is held in position throughout the examination. A final film is made at 24 hours.

J. N. Ané, M.D.

GYNECOLOGY AND OBSTETRICS

Roentgen-ray Diagnosis of Placenta Prævia, with Report of Two Cases. J. Friedman and D. O. Macdonald. Canadian Med. Assn. Jour., January, 1935, **32,** 12–14.

The authors cite the hazards of placentography with radiopaque materials and recall reports of fetal death with such manipulations. They present two cases of placenta prævia diagnosed by roentgen visualization of the placenta without any special technic, confirming the usefulness of the method previously described by Snow and used successfully in placenta prævia by Ude, Weum, and Urner. The diagnoses were proved at delivery.

William A. Sodeman, M.D.

HEART AND VASCULAR SYSTEM

Dilatation of the Pulmonary Arch in the Roentgenologic Cardiac Silhouette: Four Cases of Aneurysm of the Pulmonary Artery. L. Holst. Fortschr. a. d. Geb. der Röntgenstrahlen, 1934, **50,** 349–360.

Protrusion of the pulmonary arch in roentgenograms may be of quite varying etiology. As causes of congenital protrusion the following are mentioned:

Congenital anomaly as the result of uneven division of the truncus arteriosus; patent ductus Botalli; stenosis of the pulmonary ostium; ventricular septal deficiency; atrial septal deficiency; transposition of the large vessels, with deficiency in the ventricular system. As causes of acquired widening the following are recorded: Congestion in the pulmonary circulation as a result of mitral stenosis; cicatricial distortion of the

pulmonary artery to the left; aneurysm of the pulmonary artery and sclerosis; perforation of an aortic aneurysm into the pulmonary artery; insufficiency of the pulmonary ostium as a result of endocarditis; peripheral arteriovenous aneurysm; perforation of an aneurysm of the ductus Botalli into the pulmonary artery.

Five cases of aneurysm of the pulmonary artery are used to illustrate the discussion of the various possibilities; one of these was confirmed at autopsy. Differential diagnosis, even with due consideration of all clinical and roentgenologic symptoms, is at times impossible. The collection of more material is desirable.

H. A. JARRE, M.D.

Sclerosis of the Peripheral Veins. H. Kapp. Röntgenpraxis, January, 1935, **7**, 16–22.

Diseases of the veins play only a small rôle in roentgenology; they are phleboliths and phlebosclerosis.

Phleboliths are round or oval shadows of calcification in pelvic veins, spleen, subcutaneous angiomas, and rarely in peripheral veins. A case is reported of several hundred phleboliths in the veins of the legs, measuring from one to eight millimeters in diameter.

Phlebosclerosis is calcification or ossification in the walls of veins, either diffuse or localized; it corresponds to the calcifications in arteries, which is seen in arteriosclerosis. The calcification is found in the media. Two such cases are described. Small and extensive areas of calcification were seen in some of the veins of the legs, especially the vena saphena. The arteries did not show calcification in these cases. In one case the phlebosclerosis was very extensive and the entire vena saphena magna seemed to be a calcified tube. The condition followed after considerable difficulties from varicosities and varicose ulcers.

HANS W. HEFKE, M.D.

THE KNEE JOINT

Surgical Treatment of Benign Tumors of the Knee Joint by Means of the Juvara Operation. Ion Grigorescu and Alexander Vasiliu. Bruns' Beitr. z. klin. Chir., Dec. 8, 1934, **160**, p. 575. (Reprinted by permission from British Med. Jour., March 16, 1935, p. 44 of Epitome of Current Medical Literature.)

The authors allude to increasing adoption of conservative surgery for giant-celled tumors of bone (myeloid sarcoma, giant-celled sarcoma). Instead of amputation they recommend for small tumors, irradiation; for somewhat larger tumors, scraping-out and replacement by fragments of bone or cartilage; for large tumors, excision. For large benign tumors of the femur or tibia, near the knee joint, they recommend Juvara's operation: after excision of the tumor from the lower end of the femur (or upper end of the tibia), a "step" being made at the severed end, the excised bone is replaced by an equivalent length of the bisected upper end of the tibia (or lower end of the femur). The graft is obtained by vertical splitting of the bone by saw, and is fixed to the "step" by two circular steel ligatures. The connection of the dislocated hemi-cylinder of tibia or fibula to its fellow which remains in place is strengthened by two pegs.

For prevention of the formation of a pseudo-arthrosis, which occurred in two of the five successful cases here described, excision of the articular surface of the healthy tibia (or fibula) is advised.

It is assumed that the diagnosis of a giant-celled bony tumor or other benign neoplasm, such as enchondroma, has been made radiologically; in doubtful cases a frozen section taken during operation will decide, amputation being done when the tumor is histologically malignant.

LEAD POISONING

Diagnosis of Lead Poisoning in Children. Michio Kasahara. Klin. Wchnschr., Nov. 17, 1934, **13**, 1646. (Reprinted by permission from British Med. Jour., Feb. 16, 1935, p. 27 of Epitome of Current Medical Literature.)

The author states that lead poisoning is common in Japan because there is no law prohibiting the manufacture of rouge, toilet, and baby powders with lead. In infants, lead is ingested with the mother's milk. Poisoning occurs in infants of 6 to 24 months, breast-fed from mothers who may show no signs of the disease. They never suffer from the adult manifestations of colic, blue line on the gums, radial paralysis, hematoporphyrinuria or urobilinuria. There are two types of case: (1) Lead anemia, with lessened red blood corpuscles, low color index, increased reticulocyte count, and basophil erythrocytes: in severe cases poikilocytosis, anisocytosis, and polychromasia are present, and in this type the infants are restless, lose weight, sometimes vomit, and have a black deposit on the neck of the teeth. (2) Lead meningism, which is a seasonal condition occurring only in spring and summer. Examination of the cerebrospinal fluid shows increased pressure, xanthochromia, increased albumin, globulin, and sugar, and lymphocytosis: the fontanelle bulges, there is tremor of the hands, and convulsions occur. The diagnosis of infantile lead poisoning is usually easy from the history and symptoms.

The author states that the percentage of the basophil erythrocytes is in constant ratio to the P_H, and that a P_H of 5.54 is the best for Manson's old colorization method.

In addition to the blood picture the x-rays are typical. A thick, broad band is seen at the end of the long and short bones and along the edge of the flat bones. The author found that Lewin's test was positive in 65 per cent of cases. The skin is cleaned with alcohol. A crossed incision with a vaccination lancet is made through a drop of 25 per cent sulphur-sodium solution. In a few hours, with a positive result, blackening of the skin occurs.

THE LIVER

Roentgenologic Demonstration of Perforated Echinococcus of Liver and Spleen. F. Berner and F. Mey-

thaler. Fortschr. a. d. Geb. der Röntgenstr., 1934, **50,** 337–342.

This is a case of spontaneous perforation of an echinococcus of the liver to the bile ducts. The course of the perforation could be demonstrated roentgenologically with a reasonable degree of reliability.

The authors also report a case of spontaneous perforation of an echinococcus of the spleen to the splenic flexure of the colon, with roentgenologic demonstration of the perforating sinus.

There is illustration of the diagnostic value of kymography in a case operated on repeatedly for echinococcus of the liver. H. A. JARRE, M.D.

THE LUNGS

Reaction of Lung Tissue to Roentgen Rays. Rolf B. Engelstad. Strahlentherapie, 1935, **52,** 299–306.

The author studied the histologic changes in the lungs of 101 rabbits following exposure to roentgen rays. A wide range of doses were used (up to 9,000 r) and several qualities of radiation of from 65 K.V. (unfiltered) up to 175 K.V., 7 mm. Cu. He distinguishes four stages of reaction. First, the initial stage which appears within a few hours after the exposure. It is characterized by degeneration in the lymph follicles and some changes in the bronchial epithelium. The second stage is the latent period lasting from two to three weeks. The third stage represents the main reaction. There are degenerative changes in the bronchial epithelium and stroma, with inflammatory processes, the degree of which depends somewhat on the amount of radiation received. They are at a maximum during the first or second month and then slowly change to the fourth stage, which consists mostly of regenerative processes. There is increasing proliferation of connective tissue, with sclerotic changes. The histologic changes in the lungs are most marked after doses which produce definite skin reactions (from 2,200 to 7,040 r). Six months after the exposure the reaction usually has subsided; sometimes, however, there are still signs of degeneration in the bronchial epithelium. The mortality among the animals was very high after doses of 9,000 r or higher. In conclusion, the author states that the type of reaction was more or less the same for all doses and qualities of radiation used in his investigations. The degree of the reaction was dependent upon the total dose as well as upon the intensity of the radiation.

ERNST A. POHLE, M.D., Ph.D.

THE PANCREAS

Roentgen Diagnosis of Pancreatic Cysts. J. Monauni. Röntgenpraxis, January, 1935, **7,** 31–35.

A peri-pancreatic abscess (pseudo-cyst of the pancreas) is reported. It developed slowly after a chronic gall-bladder disease, without severe or typical attacks of pancreas necrosis. The roentgen findings before and after perforation into the stomach are described. There was a pancreatic sequestrum visible in the abscess cavity. The clinical and roentgenologic diagnosis was made by the history of the preceding cholecystopathy, the finding of sugar in the urine, and the absence of clinical and roentgenologic findings suggestive of a gastric lesion which might have caused a perforation.

HANS W. HEFKE, M.D.

PELVIMETRY

A Comparison of Clinical and X-ray Pelvimetry. Norman H. Williams. Western Jour. Surg., Obstet., and Gynecol., February, 1935, **43,** 84–91.

Williams summarizes pelvimetry, clinical and x-ray, and concludes from his studies that the former is very inaccurate while the latter is very accurate and should be employed more frequently. X-ray pelvimetry will eliminate many operations in cases in which pelvic contractions have been erroneously diagnosed by clinical methods. G. E. BURCH, JR., M.D.

PEPTIC ULCER

A Roentgenologic Investigation of the Results of Suturing of Perforated Gastric and Duodenal Ulcers. A. Lob. Fortschr. a. d. Geb. der Röntgenstr., October, 1934, **50,** 317–327.

This paper is based on the observation of 26 patients, seven of whom were examined during the first half-year, and 19 within five years after suturing of a perforated peptic ulcer.

Four questions were raised:

(1) Is it possible to demonstrate the ulcer following suturing?

(2) What type of changes in the configuration of the organ is produced by suturing?

(3) Can the cure or healing of an ulcer be demonstrated positively by roentgenologic methods; what connections are there between gastritis and ulcer?

(4) Under what conditions is a gastric resection indicated on the basis of roentgenologic findings?

The first question had to be answered in the negative, insofar as the persistence of an ulcer at the height of the inverted gastric or duodenal fold cannot be demonstrated roentgenologically.

Question 2.—Direct and indirect changes in form and function of the stomach and duodenum which have been operated upon are commonly demonstrable. Rather typical are diverticulum-like pockets of the gastric antrum or duodenal bulb; a tubular narrowing or S-shaped deformity of the antrum, at times associated with the formation of a pseudo-diverticulum; finally a straight, rigid bordering and oblique straight course of the lesser gastric curvature. These changes are chiefly produced by peritoneal adhesions. At times a small filling defect produced by the inversion of the portion of the gastric mucosa operated upon can be demonstrated. Furthermore, it is not uncommon to observe disturbances of gastric motility and tone, including formation of spasm, and also changes in gastric secretion. However, the diagnosis of true gastritis and duodenitis should be made with great caution.

Question 3.—A definite statement as to final healing or cure of a sutured-over gastric or duodenal ulcer cannot be made. Such a diagnosis must be made on clinical observation chiefly.

Question 4.—Pronounced deformities of the stomach which has been operated on often are observed without any subjective distress on the part of the patient and without demonstrable disturbance of gastroduodenal function. A secondary radical operation, therefore, is indicated only when stenosis occurs or ulceration recurs with all characteristic symptoms.

This paper bespeaks a very rational conservative viewpoint in regard to treatment of the ulcer patient and also well-founded clinical and roentgenologic experience. It is to be regretted that no roentgenologic information concerning any of the patients in question prior to the perforating accident is included in this paper, as undoubtedly quite a number of these patients would have shown considerable gastroduodenal deformities and dysfunctions before surgical interference became necessary.

H. A. JARRE, M.D.

The Incidence of Gastrojejunal Ulcer Following Gastro-enterostomy. J. William Hinton and Reynold E. Church. Surg., Gynec. and Obst., January, 1935, **60,** 65–73.

The authors present in detail a series of 13 cases of gastrojejunal ulcer following gastro-enterostomy. These occurred in a group of 79 patients who had had gastro-enterostomies for peptic ulcers. This represents an incidence of 16.4 per cent of marginal ulcers occurring in the gastro-enterostomies during a five-year period. During this interval, 583 patients with peptic ulcers were admitted, and of this group, 440 were unoperated upon before entering the clinic and 90 had been operated on for chronic ulcers. Of the 440 cases unoperated upon, after careful study and selection, only 33 patients were referred for operation.

The purpose of the authors' clinic has been to thoroughly study patients suffering from peptic ulcer to investigate the final results of the different methods of medical and surgical treatment. It is believed that frequent observations are necessary to study these cases in order to obtain accurate conclusions. The authors are also of the opinion that the follow-up letter is more misleading than helpful in drawing conclusions in these cases. In like manner, any report based on a single observation after one or several years have elapsed following operation, is also misleading.

Since three of the 13 cases of gastrojejunal ulcers occurred seven years after operation, it is believed that a ten-year follow-up is necessary. In the treatment of these cases medication should be tried for as long a period as the patient progresses satisfactorily. If the patient continues to have pain under medical treatment, it usually means that the marginal ulcer is perforating into some adjacent viscus and it is then best to submit the patient to a second operation.

J. N. ANÉ, M.D.

PERNICIOUS ANEMIA

Concerning the Question of Roentgenologically Demonstrable Gastric Mucosal Atrophy in Pernicious Anemia. R. Pape. Fortschr. a. d. Geb. der Röntgenstr., 1934, **50,** 327–336.

The thickness of the gastric mucosa cannot be judged reliably from the caliber of gastric rugæ, as these vary in the same individual to a certain degree with the amount of gastric contents, tonus, compression, and position of stomach and patient. In experienced hands the ease with which gastric rugæ may be eliminated from vision by palpation can furnish a more reliable index for the judgment of the gastric mucosa, especially its turgor. Abnormally easy elimination of gastric rugæ was observed in 50 per cent of all cases with pernicious anemia, while of all other individuals it was found in only about 20 per cent. The so-called atrophic elimination of the gastric relief, described by Chaoul, never was found in pernicious anemia and probably occurs only in cases of marked atrophic-hyperplastic gastritis.

Hyperplastic changes in the gastric mucosa are quite rare in pernicious anemia, but they were observed in two cases of gastric carcinoma complicated by pernicious anemia. In such cases the demonstration of malignant degeneration may be extremely difficult. If it is true that hyperplastic gastritis precedes the development of gastric malignancy, the observation of hyperplastic mucosal changes would seem quite important.

(Observations which depend so much on subjective conceptions cannot be regarded as very dependable.—*Abstractor.*) H. A. JARRE, M.D.

RADIATION SICKNESS

The Cause and Treatment of X-ray Sickness. F. G. Dietel and V. Probst. Strahlentherapie, 1935, **52,** 270–281.

Studies of the blood of patients who developed x-ray sickness after treatment revealed a definite drop in the red blood corpuscles as well as in the blood cholesterol. In preventing or relieving the symptoms, liver extract and cholesterol *per os* proved to be helpful.

ERNST A. POHLE, M.D., Ph.D.

RADIUM

Radium Treatment of Carcinoma of the Vocal Cords by the "Window" Method. Roland Müller. Strahlentherapie, 1935, **52,** 216–220.

Halberstaedter and Seiffert described a method in 1933 which permitted radium treatment of carcinoma of the vocal cord through a window cut into the laryngeal cartilage. The author reports his experience with this procedure. Two applicators were used by him; one contained 6.5 mg. on a surface of 1.7 × 1.3 sq. cm. filtered through 1 mm. Au. Another applicator consisted of three screens in tandem, containing 1, 2, and 3 mg., respectively, left *in situ* for from eight to nine days, giving a total dose of about 1,300 milligram-

hours. Five cases were treated in 1933; four of those remained well for from one to two years. Six cases were treated in 1934 and all were well when seen last (less than a year later). A table shows the results obtained in 74 similar cases treated since 1929. In view of the satisfactory response of the carcinoma of the larynx irradiated through a window in the cartilage, the author recommends this procedure. It has the advantage that the exposure is limited to the tumor and that there is no skin reaction. Recurrences usually occurred during the first year after treatment and none of the patients whose primary tumor healed developed metastases in the glands.

ERNST A. POHLE, M.D., PH.D.

A Contribution to the Technic of Radium Application in Cancers of the Rectum. E. Hesse. Röntgenpraxis, January, 1935, **7,** 39, 40.

Application of radium tubes to an inoperable carcinoma of the rectum is always difficult. Proctoscopic application, as well as application of the radium by introducing it with a finger, is more or less a make-shift. The author has devised a glass tube with one closed end, to be introduced into the rectum like a proctoscope, allowing visualization of the entire wall. After the correct position has been ascertained, the tube is fixed by adhesive tape and the radium is introduced and fixed in this glass tube.

HANS W. HEFKE, M.D.

The Measurement of Beta Rays of Radium in r Units. H. Smereker and K. Juris. Strahlentherapie, 1935, **52,** 327–337.

The authors measured beta rays of radium in r units by means of a small chamber made of carbon. The chamber was attached to a Mekapion (Strauss). They found that the intensity of the unfiltered beta rays is two hundred times greater than the intensity of gamma rays, assuming equal amounts of radium. One milligram of radium (RaB + RaC) emits, at 1 cm. distance, 1,720 r per hour of unfiltered beta rays.

ERNST A. POHLE, M.D., PH.D.

SARCOMA

Studies in Bone Sarcoma.—III. An Experimental and Pathological Study of the Rôle of the Periosteum in the Formation of Bone in Various Primary Bone Tumors. Alexander Brunschwig and Paul H. Harmon. Surg., Gynec. and Obst., January, 1935, **60,** 30–40.

In their third group of experiments in their series of "Studies in Bone Sarcoma," the authors investigated the rôle of the periosteum in the formation of bone in various primary bone tumors. In addition to the new bone of tumor-cell origin, bone which is not formed by the activity of tumor cells is always sought for in roentgenograms when the diagnosis of bone tumor is considered. These areas have been called "periosteal lipping" or "reactive triangles."

The authors employed the transplantable neoplasm known as rat tumor 256, which originated in the abdominal wall. Microscopically it was composed of round and spindle cells of various sizes, the latter producing collagen. Young adult rats were used in the experiments. Under aseptic conditions and ether anesthesia transplants from the tumor were inoculated into the medullary cavity and beneath the periosteum of the long bones of the animals. The neoplasm grew through and beyond the cortex, elevated the periosteum and caused it to lay down new bone in the form of radiating trabeculæ within the tumor.

In order to prove that the new bone observed in the first experiment was periosteal in origin the authors removed fragments of tumor, including newly formed bone, from the inoculated femur of some of the animals employed in the first experiment, and implanted these fragments beneath the skin, into the liver, the deep thigh muscles, and into the peritoneal cavity of other rats. Two weeks later, when the animals were sacrificed, it was noted on microscopic study that the neoplasm had grown profusely but that the fragments of bone were completely absorbed or remained as small dead spicules.

It is believed that periosteal elevation may also be an important factor in the production of new bone in those osteogenic sarcomas in which the tumor cells themselves have osteoblastic properties. In the microscopic study of these tumors, if large sections are made through the entire neoplasm, the general topography of the newly formed bone in relation to periosteum and tumor cells is of considerable assistance in making a more accurate interpretation of the histogenesis of this new bone.

It has been stated that the new bone of Ewing's sarcomas was tumor bone and non-tumor bone. The authors, however, are of the opinion that all of the new bone is of periosteal origin, being laid down as the tumor elevates the periosteum. It is believed that the so-called "onion" layers seen in roentgenograms of these tumors are due to alternate periods of rapid and slow growth of new bone of periosteal origin.

In the chondrosarcomas of bone, areas of new bone of tumor-cell origin and calcified tumor cartilage are noted irregularly distributed within them. However, in the extra-cortical portions of these tumors, fine spicules of bone of periosteal origin, which radiate from the cortex, may be present.

Fibrosarcomas of bone are osteolytic tumors and when arising centrally, they destroy the cortex, and then elevate and later disintegrate the periosteum. Very little or no osteogenic activity is exhibited by the undestroyed, elevated periosteum. If a few new bony trabeculæ are formed, they are immediately destroyed by eroding tumor cells and osteoclasts.

J. N. ANÉ, M.D.

The Treatment of Ewing's Sarcoma: Results in Zürich. R. Stewart-Harrison. Röntgenpraxis, January, 1935, **7,** 37, 38.

About 10 per cent of all malignant bone tumors are

Ewing sarcomas. They are highly radiosensitive and irradiation is the treatment of choice. The best results are seen when the protracted fractionated method is used. Of eight patients treated at the Clinic of Prof. Schinz, four were alive more than two years after roentgen therapy.

HANS W. HEFKE, M.D.

THE SKIN

The Permeability of Human Skin for Radium Emanation in Air. Gustav Lang. Strahlentherapie, 1935, **52,** 187–192.

The author, investigating the permeability of human skin for radium emanation contained in air, placed the patient in an air-tight box which contained a definite amount of radium emanation in gas form. He could show beyond doubt that the human skin is permeable for the emanation under these conditions.

ERNST A. POHLE, M.D., Ph.D.

THE STOMACH

Diverticula of the Stomach. Andrew B. Rivers, G. Arnold Stevens, and B. R. Kirklin. Surg., Gynec. and Obst., January, 1935, **60,** 106–113.

The authors review their series of 33 cases of diverticula of the stomach, and present in detail 14 cases of this group which were proved by operation or postmortem examination. Including this series of 33 patients with diverticula, 141 cases have been reported in the literature since the first report by Helmont in 1804.

Ten specimens in the authors' series were removed in 10 of 11,234 exploratory operations on the stomach, or 1 in 1,235. Four cases were found in the course of 3,662 routine postmortem examinations, or 1 in 917. Roentgenologic diagnoses of gastric diverticula were made in 25 cases of 91,532 routine roentgenologic examinations of the stomach since 1912. The roentgenologic diagnosis of this condition is very difficult as shown by the fact that in six cases of the group in which diagnosis was made by means of the x-ray, exploratory operations revealed only two to be true diverticula; in the four others, diverticular protrusions were found to be due to perforating peptic ulcer or to carcinoma.

The authors suggest the following classification of diverticula: (1) True diverticula; (2) acquired, true diverticula, consisting of the pulsion and traction types; (3) false diverticula or diverticular formations. The true diverticula are those in which the pouch includes all coats of the gastric wall without evidence that organic disease was the causative factor. These are believed to be congenital. In the acquired, true diverticula, while all coats of the gastric wall are present some thinning may be noted. There is also evidence that some pathologic condition has caused the pouching, such as adhesions or a trichobezoar as reported by Schulten. The group of diverticular formations or false diverticula includes those cases in which there is a break in the gastric wall as a result of disease.

The ages of the patients in the authors' series of gastric diverticula ranged from 25 to 59 years, with an average age of 42 years. Sex was not an important factor as six of the patients were men and eight were women.

A review of the literature showed that gastric diverticula occurred most frequently in the cardia, just below the esophageal juncture on the posterior wall and usually nearer the lesser curvature. In the group of 14 cases, six diverticula were found immediately adjacent to the pylorus, six at the cardia, and two, some distance from the pylorus on the posterior wall. The sizes of the pouches varied from 1 centimeter in diameter to 7.5 centimeters.

Associated gastric disease was found in four of the 14 cases. In two cases there were ulcers adjacent to the diverticula, in one, an adenomyoma in the diverticulum and a duodenal ulcer, and in the final case, a sarcoma in the wall of the diverticulum.

In four cases of the group of 14 diverticula, symptoms were noted which were attributable to the presence of diverticulum, and in four cases symptoms were noted because of the associated gastric pathology.

The diagnosis of a true gastric diverticulum is impossible without the aid of the x-ray, as there are no characteristic clinical symptoms. The roentgenologic diagnosis is extremely difficult. Pendergrass has outlined the differential diagnosis of diverticulum and hernia through the esophageal hiatus.

Because of the difficulty of determining accurately the nature of the diverticulum of the stomach, it is believed that with positive roentgen evidence and the presence of indigestion, it is safer to advise surgical exploration in these cases.

J. N. ANÉ, M.D.

The Importance of Insufflation for the Roentgenologic Diagnosis of Gastric Tumors. Fritz Eisler. Röntgenpraxis, January, 1935, **7,** 1–8.

Sixty-five cases of gastric tumors were examined by the method of insufflation and the results enumerated. The technic is of very great importance. Two different methods have been used: one is insufflation in combination with a contrast material; the other, insufflation without a contrast material. Air or gas can be introduced either by a duodenal tube or by administering acidum tartaricum and sodium bicarbonate. One must avoid too much distention of the stomach, and undesirable symptoms, such as vomiting and belching, can be avoided by giving only 1 gram of acidum tartaricum and 2 grams of sodium bicarbonate. It has been figured out that from 250 to 500 c.c. of carbon dioxide is formed in the stomach and that this carbon dioxide is present for from 5 to 10 minutes. If the stomach is very large and the elasticity has to be tested, a large amount of chemicals has to be given. Since small doses are given, there is no danger of perforation. The examination has to be done on an empty stomach; the patient takes 1 gram of acidum tartaricum in 30 c.c. of sugar water. Immediately afterward he takes 2 grams of sodium bicarbonate in 30 c.c. of sugar water.

Fluoroscopic examination checks the optimal time for roentgenograms in the standing and recumbent positions. A tumor appears as a bulging of the contour on profile, either smooth or nodular. Flat tumors, which are elevated only slightly from the level of the gastric wall, are difficult to see. With more intensive insufflation, the infiltrated region retains its shape, while portions with normal elasticity balloon out.

In the majority of the cases, insufflation does not offer advantages over the usual barium examination. Tumors situated in the cardia and close to it are a good indication for the use of this method, especially, because the routine examination is very difficult in this area.

An improvement in the results of x-ray examination is to be expected when one has to consider the question of operability. The method of insufflation is not very satisfactory in tumors of the pylorus; only occasionally is it possible to add something to the diagnosis made by the barium examination. In extra-gastric tumors this type of examination seems to give more information. The insufflation method is to be used only in combination with, and as an addition to, the examination of the stomach with the barium meal.

HANS W. HEFKE, M.D.

SYRINGOMYELIA

Treatment of Syringomyelia by X-rays. E. M. Haworth. British Jour. Radiol., November, 1934, **7**, 643–653. (Reprinted by permission from the British Med. Jour., Jan. 12, 1935, p. 8 of Epitome of Current Medical Literature.)

The author describes cases of syringomyelia successfully treated by x-rays. He thinks that the type of technic adopted is relatively unimportant since so many varieties have proved equally effective. He gives small doses of from 150 to 180 r with hard rays at progressively increasing time intervals. The apparatus consists of a continuous potential condenser unit with a Wintz tube stand. The constant factors are: 180 K.V.; 2 ma.; filtration with 0.5 mm. zinc and 3 mm. aluminum, and 30 cm. focus-skin distance.

The first case was treated within a month of the appearance of sensory changes and reacted immediately. Except for one relapse, the progress in subjective and objective symptoms was maintained. In another case, however, although treatment began within three years of the onset, only a few of the symptoms seem to have improved, namely, swallowing, speech, and a return of heat sensation about the affected elbow-, knee-, and ankle-joints. There was also no definite evidence that the disease had been arrested, for the muscles of the right arm and leg were becoming involved. A third case showed a definite amelioration in the subjective symptoms without any marked change in the objective signs, and a fourth was characterized by a most striking recovery of sensation, freedom from pain, and ability to resume work. The importance of beginning treatment early is brought out by another case in which twenty-five years had elapsed between the origination of the disease and the start of x-radiation. The pain was entirely abolished, but the development of telangiectases of the cervical region brought the treatment to an end, although there was progressive wasting and weakness of the arms, and the lower limbs were becoming increasingly spastic. There was some indication in another case that the pathologic process in the spinal cord has been definitely circumscribed and localized by the x-rays.

Haworth adds that the importance of early diagnosis is well brought out in his small series. Whether the compression of the normal neuroglia round the central canal be due to an overgrowth of embryonic glial tissue and nerve fibrils or to proliferating young blood vessels, it appears certain that the process may be arrested by exposure to x-rays, and that repair is the more likely when there has as yet been no cavity formation and liquefaction.

TUBERCULOSIS, PULMONARY

The Blood Picture in Pulmonary Tuberculosis Especially the Relation between Sedimentation and Shifting to the Left. Sigurd Cold. Ugesk. f. Læger, Oct. 4, 1934, **96**, 1083. (Reprinted by permission of British Med. Jour., March 16, 1935, p. 46 of Epitome of Current Medical Literature.)

The author has compared the leukocyte count with the sedimentation test in 125 patients under treatment at Vejlefjord Sanatorium, Denmark, during 1933. The tests were repeated at intervals of a month, and all the patients were suffering from active tuberculosis of the lungs or pleuræ. Normal findings with both tests were by no means rare, but while a normal sedimentation rate was observed both with chronic cases tending toward arrest and with definitely progressive cases, a normal leukocyte count was never found associated with recent extension of the disease. It would, therefore, seem that in pulmonary, as distinct from pleural, disease the leukocyte count is superior to the sedimentation test as an index to activity and progress of the disease. This generalization does not, apparently, apply to tuberculous pleurisy, in which the sedimentation rate may be greatly increased, while the left-hand drift of the leukocyte count is often slight or even non-existent. This difference in the behavior of the two tests in relation to disease of the lungs and pleuræ, respectively, is of some value in the differential diagnosis. To clarify this point the author refers to the case of a patient whose artificial pneumothorax was complicated by a slight pleural effusion. The temperature was normal and the sedimentation rate slow, but there were tubercle bacilli in the sputum, with a left-hand drift of the leukocyte count. When the patient became febrile it was not at first clear whether the fever was due to an increase of the effusion or activation of the pulmonary disease. The sedimentation rate remained normal, while the left-hand drift was much increased. The cause of the fever was traced by the x-rays to a recent extension of the disease in the other lung. The author concludes that even when the technic of a blood count is so simplified that

attention is paid almost exclusively to the neutrophils, useful information can be obtained as to the activity and spread of tuberculosis.

TUMORS (DIAGNOSIS)

Ventriculography in the Diagnosis of Intracranial Tumor. Leonard C. E. Lindon. Australian and New Zealand Jour. Surg., January, 1935, **4,** 271–278.

Lindon considers ventriculography justifiable only in those cases in which cerebral edema has obscured the patient's intelligence so that examination is unreliable, after repeated clinical examinations fail to further the localization of a tumor, or when the physical signs are too contradictory to support a diagnosis. However, he believes it wrong to expect too much from ventriculography and objects to the use in diagnosis of minute deformities in the ventricles, because of possible incomplete replacement with air. He draws conclusions on gross abnormalities only. Specifically, conclusions are based on gross displacement or midline shift, gross alteration in the size and shape of the ventricles, and on gross asymmetry or deformity of one ventricle. These changes in the character and location of the shadows serve their greatest purpose in differentiating between tumors above and those below the tentorium. Illustrative cases, all proved at operation, are reported and diagrams of the ventriculographic findings are included.

WILLIAM A. SODEMAN, M.D.

TUMORS (THERAPY)

Roentgen Therapy of Metastases of Malignant Tumors. Herbert Herzum. Med. Klin., Nov. 16, 1934, **30,** 1524. (Reprinted by permission from British Med. Jour., Feb. 23, 1935, p. 32 of Epitome of Current Medical Literature.)

The author asserts that radiation by x-rays or radium has a beneficial effect on many metastatic new-growths. Too often, when metastases occur after operative removal of the primary tumor, it is assumed that nothing else can be done, or that radiation only produces carcinomatosis, and the patient is left to die. In 14 cases, of which 12 were cancers of the breast, bronchus, thyroid, or uterus, and two were sarcomas of the testis, only four cases received no benefit. Metastases in the spine, lung, liver, and eyelid were treated. Herzum found, in confirmation with other reports, that metastases in the spine react best to radiation. Manifestations of compression disappeared to a large extent, the general health improved with increase of appetite and weight, and pain was alleviated. In general, treatment of metastases should be carried out, unless the primary tumor has progressed too far and the patient's condition is poor.

Contribution to the Problem of Radiation Therapy in Seminoma. André Gilliard. Strahlentherapie, 1935, **52,** 226–241.

Seventeen cases of seminoma are analyzed by the author; 11 of these were treated during the period from 1924 to 1930. Two patients, one with seminoma of the testicle and one with seminoma of the ovary, remained cured after periods of eight and ten years, respectively. Six cases were treated during the period from 1930 to 1934. Two are alive after an observation period of three years; one is a seminoma of the testicle, the other a seminoma of the ovary. The treatment consisted usually of a combination of operation and irradiation. A few case histories are appended; in each instance the technical data of roentgen therapy are given. Lately the author has administered ovarian extracts combined with irradiation in seminoma of the testicle. However, it is too early to offer any definite conclusions.

ERNST A. POHLE, M.D., Ph.D.

THE UTERUS

The Histological Classification of Cancers of the Uterine Cervix and the Relation between the Growth Structure and the Results of Radium Treatment. H. Chambers. Am. Jour. Cancer, January, 1935, **23,** 1–15.

Chambers has analyzed 500 cases of cancer of the cervix to determine the relationship between their structure and the results of radium therapy. The method of grading, an inherently difficult problem, is based on the extent of differentiation and degree of cell activity, with a consideration of the general architecture of the growth as well. Squamous-cell types are divided into four grades: Grade I includes all typical cases of the adult common type of squamous carcinoma; Grade II, the types composed of the spindle cells; Grade III consists of all cases in which there is a clear tendency to form stratified epithelium, with subgrouping according to extent of differentiation; Grade IV includes all anaplastic growths showing no formation of stratified epithelium. Treatment used is the technic of Forssell modified to improve the distribution of the radium. No modifications were made for various histologic types.

The highest percentage of local cures, 73.8 per cent, was obtained in the squamous group, Grade III, transitional type. In adenocarcinoma no evidence of insensitivity to radiation was obtained, local cures occurring in 72.9 per cent of the cases. None of the histologic grades showed a difference of more than 15 per cent in either local cures or in the number of 3-year survivors.

W. A. SODEMAN, M.D.

VARIED CLASSIFICATIONS

The Nourishment in Cases of Radiological Reaction in the Mucous Membranes of the Mouth and Throat. Kule Palmstierna. Acta Radiologica, 1935, **16,** 301–303.

The reactions following radiological treatment of the mucous membranes of the mouth and throat make it very difficult for patients to take the proper nourishment. In an attempt to remedy this difficulty the author has concocted the following mixture: 1000 gr. of milk, 40 gr. of butter, 20 gr. of wheat flour, 30 gr. of

maltose, and the yolk of one egg. This contains 1,100 calories per liter, with 32 gr. of albumin, 70 gr. of fat, and 80 gr. of carbohydrate. The author says that 1.5 liters of this mixture will satisfy one's daily caloric requirements.

G. E. BURCH, JR., M.D.

Studies Regarding the Influence of Roentgen Rays on the Blood Sugar in Man. K. Brochner-Mortensen. Strahlentherapie, 1934, **51,** 675.

The author studied the effect of roentgen rays on the blood sugar in man. In a few instances he found a slight increase following the exposure. However, the sugar curve following intravenous glucose injection was the same for both irradiated and non-irradiated patients.

ERNEST A. POHLE, M.D., Ph.D.

Therapy with Short Electric Waves. Erwin Schliephake. Strahlentherapie, 1935, **52,** 193–205.

The author, who has done most of the original work with short electric waves, presents a brief discussion of the technical, biological, and clinical principles of this new type of therapy.

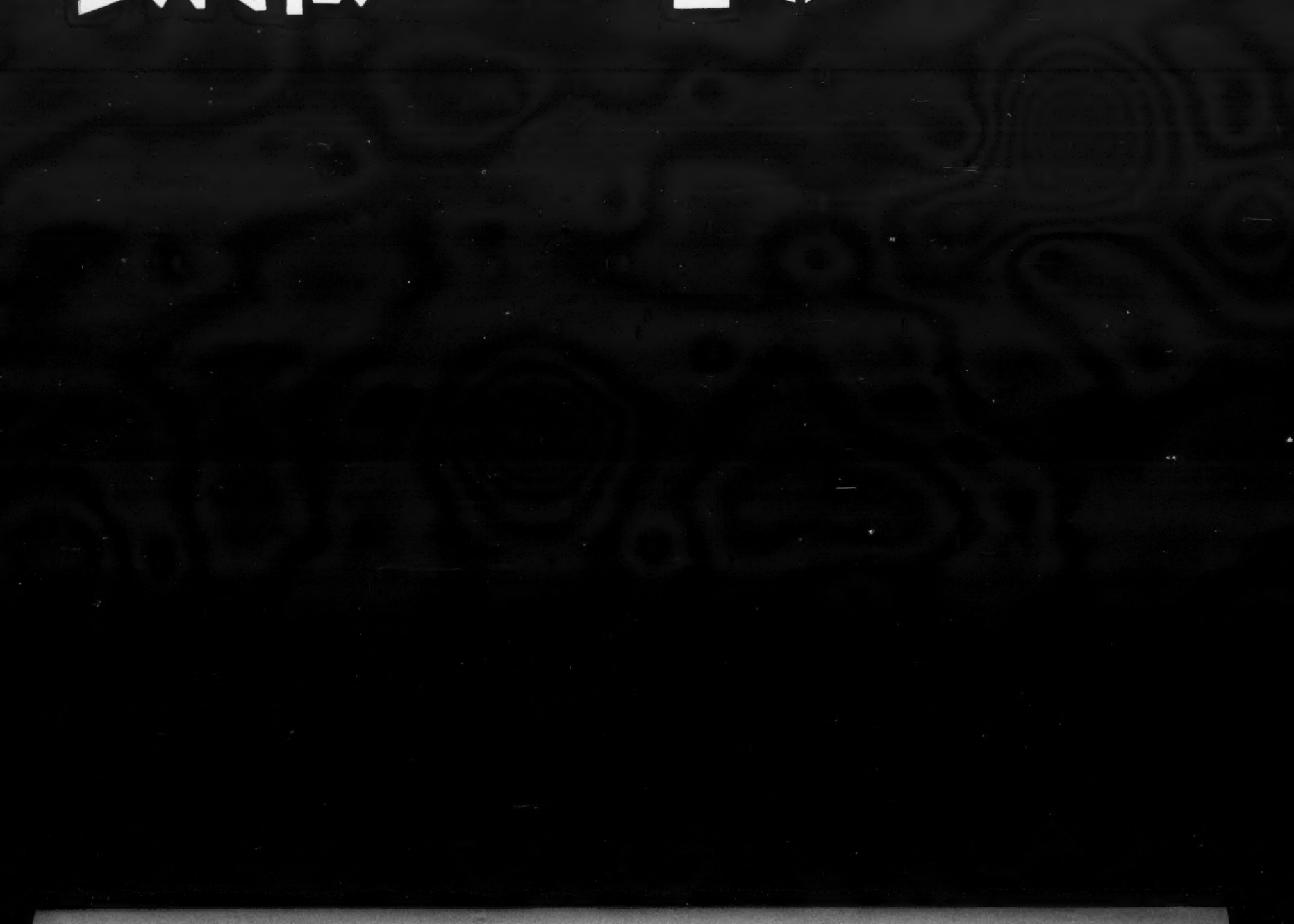
ERNST A. POHLE, M.D., Ph.D.

Roentgen-ray Considerations in Injury Cases. William S. Greenleaf. Jour. Iowa St. Med. Soc., March, 1935, **25,** 137–139.

The use of the roentgen ray is almost indispensable in the treatment of injury cases. It is used in the diagnosis of fractures, non-penetrating wounds which may appear trivial but may prove to be serious (as a ruptured viscus), penetrating wounds, the location of foreign bodies, etc. It has its prognostic application also.

G. E. BURCH, JR., M.D.

Saturation Potentials in Ionized Gases. Erich Both. Strahlentherapie, 1935, **52,** 143–151.

The author determined the saturation potentials (degree of saturation 98 per cent) for various gases, as for instance, nitrogen, argon, air, oxygen, CO_2, etc. He compared the experimental values with those calculated by a formula and found that there was fair agreement between the two values for nitrogen, argon, air, and oxygen.

ERNST A. POHLE, M.D., Ph.D.